SIEMENS

MAMMOMAT Novation DR

SP

Start-up

System

with WH AWS, VA11C/VA11D

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Table of Contents 3

1 Prerequisites 6

Configuration . . . 6
Meters, appliances and tools . . . 7
Auxiliary Materials . . . 7
Phantoms / Auxiliary . . . 7
Tools . . . 8

2 Important Notes 9

Symbols . . . 9
Factory Adjustments . . . 10
Special checks and protocols . . . 11
Acceptance test . . . 11
Protective measures . . . 12
System power supply . . . 12
PC boards . . . 12
Metal curtain . . . 12
Measurements with the oscilloscope . . . 13
Service software . . . 14
Delay times between two exposures . . . 15
Rebooting the system . . . 16

3 Power up the MAMMOMAT 17

Radiation protection door switch (optional) . . . 17
External exposure lamp (optional) . . . 18
Mains voltage . . . 19
Electrical power to mains input: . . . 19
Connections . . . 20
Measuring the line resistance . . . 21
Start-up of the MAMMOMAT system . . . 21

4 Detector installation 24

Unpacking of the detector . . . 24
Mounting the detector . . . 27
Mounting the grid . . . 28
Adjusting the switches . . . 30
Mounting the covers . . . 31

5 Mechanical covers 32

Mounting covers . . . 32
Cable duct covers . . . 32
Swivel arm covers . . . 32
Side cover . . . 32
Front cover . . . 33
Stand covers . . . 34

Face shield . . . 36
Mechanical Checks . . . 36
Checking the field light time . . . 40
Checking the compression device . . . 41
Decompression button . . . 42
Checking the OPCOMP . . . 42
Checking the exposure blocking . . . 43

6 X-ray tube checks 44

Tube high voltage, current and mAs values . . . 44
Preparation . . . 44
Measurement method . . . 44
Checks with a large focus and without AEC . . . 46
Checks with a small focus and without AEC . . . 46
Checks with a large focus and with AEC . . . 47

7 Collimator Adjustment 49

Automatic collimator . . . 49
Collimator reference axis . . . 49
Collimator beam check and calibration . . . 50

8 Checking dose settings 55

Enable/Disable Dose Calculation . . . 55
Configuring of Dose Calculation System . . . 55
Label . . . 56
Checking OPDOSE . . . 57
Checking the AEC dose settings . . . 58

9 Image Quality 63

Checking Grid Lines . . . 63
Preconditions . . . 63
Checking visibility of grid lines . . . 63
Test 1 protocol . . . 64
Measuring grid lines . . . 65
Eliminating grid lines . . . 66
Checking Image Quality . . . 71
Creation of a new pixel map (if necessary) . . . 76
Tests from the Quality Control Manual . . . 80
Process parameters . . . 80

10 Final procedures 89

Disabling the film exposure . . . 89
Settings date and time . . . 90
MAMMOMAT Stand . . . 90
BRICK . . . 90
Service PC and measuring instruments . . . 92
Saving the configuration file . . . 92

Remove the measuring instruments . . . 93
Checking the protective grounding resistance . . . 94
Warning label on control panel . . . 95
Protocols . . . 96

11 Start-up Protocol 97

Site Data . . . 97
Auxiliary materials used . . . 98
Installation and start-up steps performed . . . 99
Startup Settings . . . 101
Tube high voltage, current and mAs values . . . 101
Collimator beam calibration . . . 103
Collimator field light calibration . . . 103
Collimator wing difference . . . 103
AEC dose settings . . . 103
OPDOSE settings . . . 104
Check of grid lines . . . 104
Display contrast and density of images . . . 105
Activity report . . . 105
General Remarks . . . 106

12 Appendix 108

Troubleshooting image quality . . . 108
Working with the service PC . . . 112
Description of the syntax used in these instructions . . . 112
Connecting the service PC . . . 113
Configuring the service PC . . . 113
Configuring the computer BIOS . . . 113
Configuration of Windows® 2000 Pro . . . 113
Starting up and using the service PC . . . 114
Troubleshooting PC connection . . . 114

13 Changes to the previous version 116

Configuration

The configuration of the MAMMOMAT NovationDR installation depends on the customer's choice

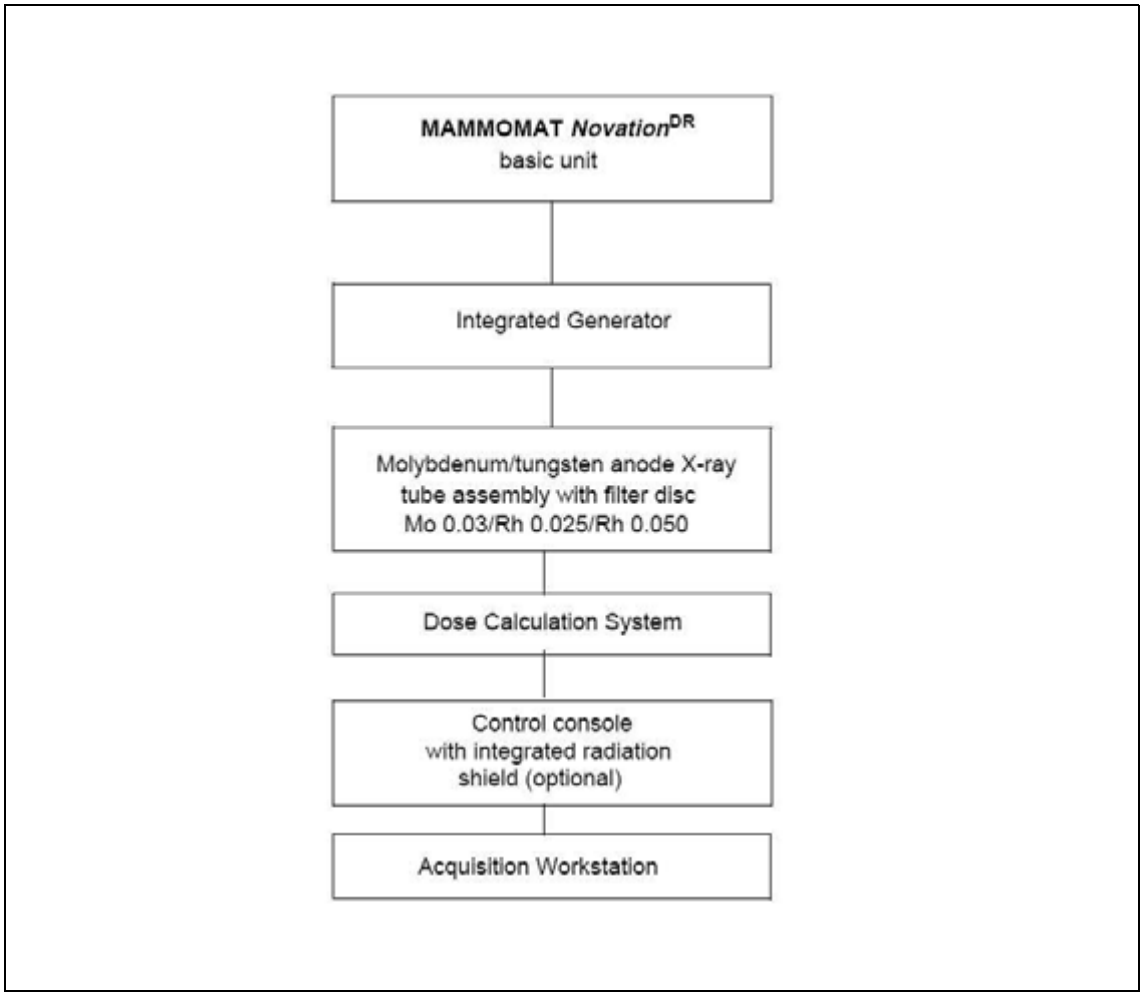


Fig. 1: Configuration

Unless otherwise stated, these instructions describe the

- MAMMOMAT NovationDR Stand with the integrated generator,
- radiation shield with the integrated control console
- detector and
- Acquisition Workstation (WH AWS).

Depending on the installation configuration, some points may be omitted.

Meters, appliances and tools

Auxiliary Materials

NOTE	**Calibrated instruments are required.**

Tab. 1 Meters, appliances and tools

Item	Remarks	Material Number	With System
Oscilloscope >50MHz with memory	e.g. TEKTRONIK 314		No
Digital multimeter including an mAs meter	e.g. FLUKE 8060A or FLUKE 87	97 02 101 97 03 976	No
Service PC	See the CS Intranet (**CS/For Service/Common Services/Service Laptop for CSEs**) for details.		No
Power line impedance meter		84 28 104	No
Power ground-wire tester		44 15 899	No
Luminance meter (for monitor calibration)	e.g. Mavo Monitor or Wellhöfer LXplus (05 146 167)	97 02 432	No
Luminance meter (measures the light intensity from the X-ray field)	e.g. SMfit Mammo	88 81 281	No
Dose meter	e.g. Solidose	88 81 323	No
Ion chamber	For dose meter Solidose	88 81 315	No
Densitometer	e.g. X-Rite 331	97 02 416	No
A non-invasive digital kV meter	If not available in the district, a scope can be used instead		No

Phantoms / Auxiliary

Tab. 2 Phantoms and auxiliaries

Item	Remarks	Material Number	With System
RMI 156		88 81 265	No
Three, 2 cm plexi (PMMA)		65 61 232	Yes
1 cm plexi (PMMA)		65 61 224	No
2 mm steel plate, 30x25 cm		66 55 851	Yes
2 mm steel plate, 3x10 cm		66 55 844	Yes
One 0.1 mm, two 0.2 mm and one 0.5 mm sheets of aluminum 99% (1100) alloy, 4x4 cm		88 81 273	No
Mammography line pair phantom	2-10 lp/mm	88 81 299	No
Collimator mounted plexi (4 cm)			Yes
Compression plate simulator			Yes
4.2 cm plexi	Size of the detector	74 47 720	No
Ethernet cable			No
Serial PC cable	RS232 / Array / BRICK	66 55 745	Yes
Serial PC cable	RS232 / Stand	99 00 440	No
Cassette / Film 24x30 cm			No
Centering cross		96 60 051	No

Tools

Tab. 3 Tools

Item	Remarks	With System
Standard installation and service tools		No
Torque wrench for bolting the stand/console to the floor		No
Electrical screwdriver with adjustable torque is recommended		No

Symbols

: This symbol indicates exposure to X-ray radiation

This symbol indicates that the measured values have to be entered in the "Startup Protocol" on (Start-up Protocol / p. 97).

Factory Adjustments

The **MAMMOMAT Novation^{DR}** is adjusted, programmed and tested in the factory, leaving the adaptation to the on-site mains voltage, adjustment of the AEC and the functional tests to be performed.

When the measurements to be made (kV, mAs, etc.) are within the tolerances stated in these instructions, this confirms that the settings made in the factory have not changed and the equipment is fully serviceable.

The equipment is tested with **400 V, 2-phase** in the factory.

Special checks and protocols

Acceptance test

The acceptance test of the MAMMOMAT Novation^{DR} is recommended to be performed whenever a new MAMMOMAT NovationDR system has been installed and whenever changes that might affect performance have been made to an existing system.

The acceptance test of MAMMOMAT Novation^{DR} involves performance of all QC procedures in this **Quality Control Manual** (SPB7-250.623.02...) ensuring that a basic minimum image quality criteria is met before the system is used with patients.

All yearly tests from the **Quality Control Manual** have to be performed.

Depending on the country where the system is installed, additional tests have to be performed.

- Tests according to RöV §16 regulations must be performed in **Germany**.
- Tests according to DHHS regulations must be performed in the **USA**.

  Maintenance measurements must be made according to the **DHHS Maintenance Instructions** (SPB7-250.662.01...) and the **DHHS Supplements to the instructions for use** (SPB7-250.661.01...). Results must be recorded in **DHHS Measurement certificates** (SPB7-250.663.01...).

Protective measures

System power supply

Before you begin working on equipment, it is very important that you disconnect it from the power supply at the main circuit breaker. Before removing or inserting any of the printed circuit boards, switch off the equipment.

⚠WARNING

If the system is only switched off at the control panel, the line voltage will still be present at the generator line connection (see wiring diagram).

A life-threatening hazard of electric shock exists.

➪ **Disconnect the mains cable and follow the instructions presented here.**

⚠WARNING

After the system shuts down, there may still be 380 V DC present on the intermediate circuit.

➪ **A life-threatening hazard of electric shock exists.**

PC boards

⚠CAUTION

The printed circuit boards contain highly electrostatically-sensitive components.

If disregarded, the components could be damaged.

➪ **Use ESD equipment, ground prior to making contact, and place the components on a conductive surface.**

Metal curtain

⚠WARNING

The edges of the metal curtain on the stand are very sharp.

They may cause severe injury.

➪ **These strips must always be applied onto the edges of the metal curtain during service and maintenance work.**

Apply the protective strips after removing the covers from the stand. Remove the protective strips only when the covers are to be mounted or when vertical adjustment of the swivel arm system is necessary.

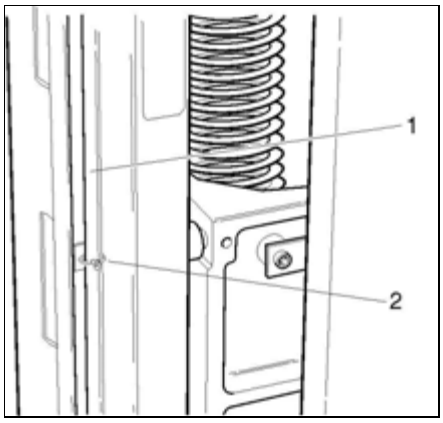


Fig. 2: Protective strips for metal curtain

Pos. 1 protective strips

Pos. 2 holders

Holders (2/Fig. 2 / p. 13) for storing the protective strips when not in use are provided on both sides of the curtain.

Measurements with the oscilloscope

⚠WARNING

Under no circumstances should the existing ground conductor in the mains cable be disconnected when operating the oscilloscope.

There is a life-threatening hazard of electric shock.

➪ **For measurements in which a resulting ground loop may affect the measuring result, use the differential amplifier (difference measurement).**

Service software

The MAMMOMAT Novation^{DR} has various service software packages:

- Acquisition Workstation

  The Acquisition Workstation service software is Web-based and can be started from the Options application menu.

- BRICK

  The BRICK service software can be accessed via the Acquisition Workstation.

- MAMMOMAT stand.

  The Service PC is required for MAMMOMAT stand service software

When the generator is switched off with the service PC connected, wait approximately 5minutes before switching it on again (The LEDs H3 and H4 have to be off).

A description of the various service software packages can be found in the MAMMOMAT NovationDR manuals for Software (SPB7-250.816....).

NOTE	**When the generator is switched off with the service PC connected, wait approximately 5minutes before switching it on again (The LED's H3 and H4 have to be off).**

A description of the various service software packages can be found in the MAMMOMAT Novation^{DR} manuals for **Software (SPB7-250.816....)**.

Delay times between two exposures

The delay times listed below must be followed to prevent the tube from overheating.

Tab. 4 Delay times between two exposures

Exposure mAs value	Delay time between two exposures (seconds)
max. 100	min. 15
max. 200	min. 30
max. 300	min. 45
max. 400	min. 60
max. 500	min. 75

Rebooting the system

NOTE

The system should be switched off completely once a week; no power on the stand!

Radiation protection door switch (optional)

It is optional to connect a radiation protection door switch to the MAMMOMAT Novation^{DR} master board D750 connector X754.

NOTE **A radiation protection door switch is not delivered with the MAMMOMAT Novation^{DR}.**

A 15V / 5 mA signal is used in the door switch circuit. When the signal path is opened by the door switch, the exposure will immediately be terminated.

Fig. 3: Connecting the door switch

1. To connect a door switch, remove the jumper from the X754 (Pin 1,2) located on the master board D750, see Fig. 1, and connect the door switch instead.

If a radiation protection door switch is not used, a jumper, see (Fig. 3 / p. 17), on the master board 750 at connector X754 (Pin 1,2) has to be inserted.

External exposure lamp (optional)

This should only be performed if the customer requires it.

The connection on the master board works as a shutter. The signal from the master board is only active during exposure, thus the exposure lamp will only be lit when the signal is active.

Connect the cable to the lamp holder in series with the power supply.

⚠CAUTION **When connecting the exposure lamp to the master board, make sure that the electrical load does not exceed 24VAC / 25W**

➪

1. Connect the exposure lamp to the connector X759 located on the master board D750, see (Fig. 4 / p. 18).

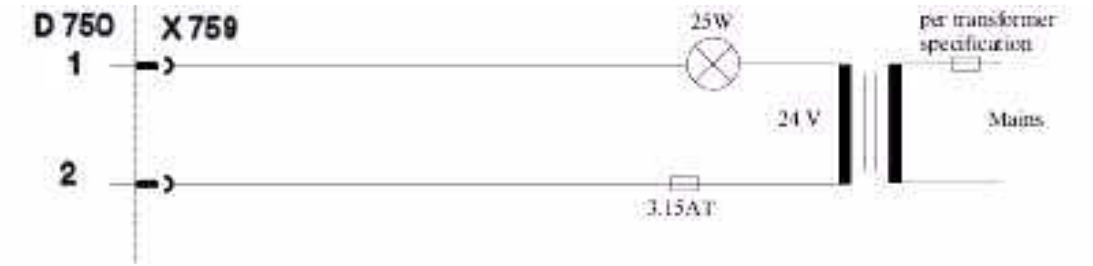
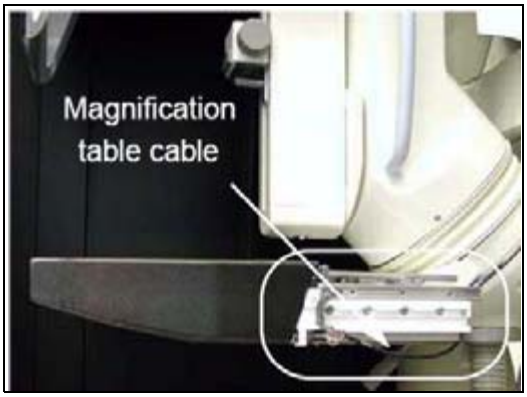


Fig. 4: Connecting the exposure lamp

NOTE **Do not use power from the MAMMOMAT stand.**

Mains voltage

⚠WARNING **Before the power for the MAMMOMAT is turned on, make sure that the cable plugs (left and right of the system) for the magnification table are not shorted.**



➪

The mains input can be either 1-phase or 2-phase, 50 or 60 Hz.

Electrical power to mains input:

Mains voltage	1-phase:	208, 230, 240 and 277 V ±10%
	or	
	2-phase:	208, 230, 240, 277 and 400 V ±10%
Mains Frequency:	50 or 60 Hz	
Maximum load:	10kVA (momentary) and 0.8 kVA (long time load).	
Fuse:	25 A (external) 208 -> 400 V.	

Connections

Power system	Type of connection	Power voltage	Power connections
Single phase	Phase to neutral	208 V-277 V	Connect to **3** and **4** (see No.1 /(Fig. 5 / p. 20))
Two phase	Phase to phase	208 V-400 V phase to phase. Note: Max. 277 V phase to neutral/ground allowed.	Connect to **3** and **4** (see No.1 /(Fig. 5 / p. 20)) Use two phases (of three) in a normal power distribution system.The leftover wires, neutral and the third phase may be connected to terminal **1** and **2**. See (Fig. 5 / p. 20).

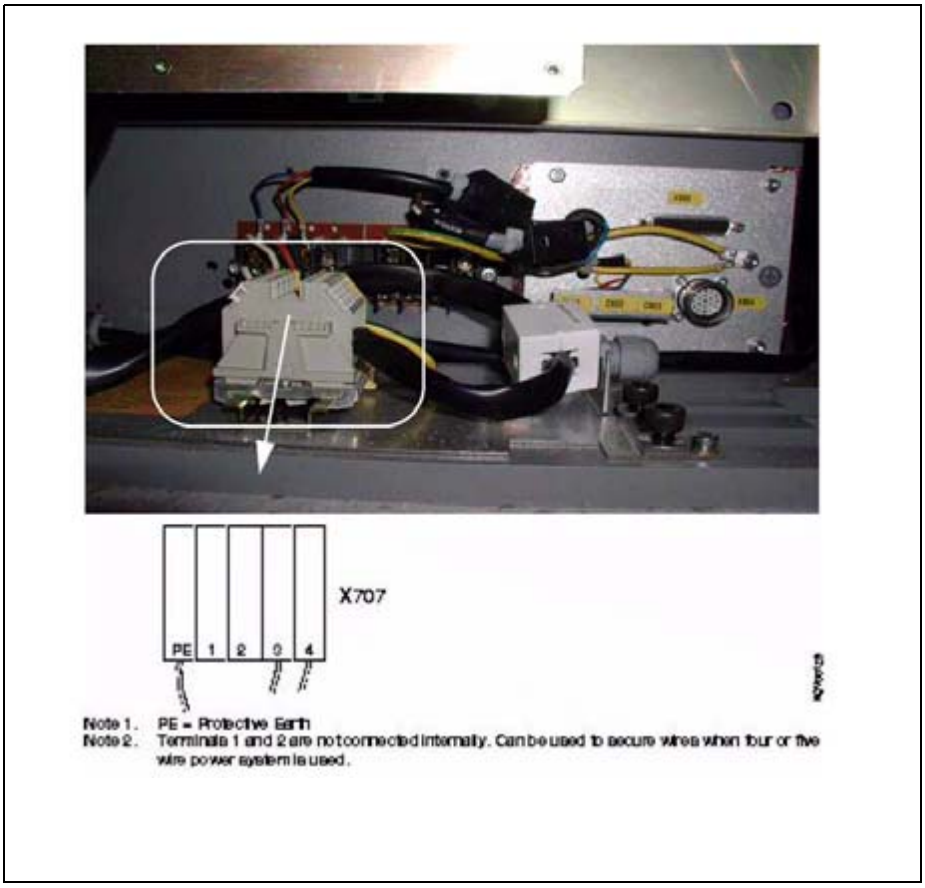

X707
PE
1
2
3
4
Note 1. PE = Protective Earth
Note 2. Terminals 1 and 2 are not connected internally. Can be used to secure wires when four or five wire power system is used.

Fig. 5: Three incoming mains cables

1. Connect the incoming mains cable to the mains terminal ((Fig. 5 / p. 20)) at the bottom of the back of the stand.
2. Strain-relieve the incoming mains cable.

Measuring the line resistance

1. Connect the line resistance meter to the mains input terminal on the stand.
2. Mains supply ON.
3. Carry out measurement.
4. Mains supply OFF.

To achieve the maximum output, the line resistance must not exceed the following values

Tab. 5 Measuring the line resistance

Nominal Input Voltage [VAC]	Line Resistance Ri_{max} [Ohm]
208	0.45
230	0.50
240	0.60
277	0.65
400 (2-phase)	0.85

Start-up of the MAMMOMAT system

Switching on the system

1. Switch **ON** the external main power switch in the room.
2. Verify that the generator and BRICK power up properly.
3. Wait **5 minutes**.
4. Press the power **ON** button on the control console to activate the MAMMOMAT Novation DR. The internal monitoring system automatically performs a functional check of the MAMMOMAT Novation DR. As a result dr is displayed on the film density display on the control panel to indicate that the communication with the MAMMOMAT Novation DR system is working properly when the detector wing is selected.
5. Switch **ON** the PC and the screen at the acquisition workstation.

Checking the Brick and Acquisition Workstation communication

Verify that the communication between the BRICK and the acquisition workstation is working properly (LEDs V2 and V3 on the BRICK must be green). The PXCM includes three status LEDs:

V1—Fiber-optic communications status. A red LED that lights to indicate lack of communication from the DROC. Likely causes are misconnected fiber-optic lines or the detector being turned off.

V2—PXCM status. A green LED that flashes to indicate normal operation of the PXCM. If this LED does not light for a significant amount of time (that is, 2 to 3 minutes), restart the system.

V3—Power status. A lit green LED that indicates that the PXCM is providing power to the detector.

Checking the supply voltages

1. Switch **ON** the system.
2. Check that the following LED indicators (top to bottom) on the mains input converter (generator) are lit:

Tab. 6 LED check

LED check
28 VP
5 VF
- 15 V
+ 15 V
28 VS
5 V

Checking the microprocessors‘ LEDs

The following LEDs on the microprocessor p.c. boards (D750) indicate whether the relevant microprocessors are operating correctly.

1. Mains **ON**.
2. Check that the CPU IC107 status LEDs D13, D14, D15 are continuously **ON** and LED D16 is **OFF** for approximately 1 second after the mains is switched on.
3. Switch **ON** the MAMMOMAT NovationDR system power by pressing the ON button on the control console. After approximately 5 seconds check that the CPU IC107 status LED D13 is flashing rapidly and the LEDs D14, D15 and D16 are **OFF**.
4. Check that LED D25 on the master board D750 is flashing slowly (once per second).

Arranging the swivel arm

1. Remove the protective strips from the metal curtain.
2. Run the lifting carriage upwards.
3. Attach the protective strips back onto the metal curtain.

4. Rotate the swivel arm system to **0 degrees** by pressing one of the switches for clockwise rotation on the supporting arm.
5. Unlock the wing and move the film wing to the park position.

Start-up of the Acquisition Workstation

System-specific data has to be entered and set.

The start-up and configuration of the acquisition workstation is described in the document **Start-up, WH AWS** (SPB7-250.815.02...).

Unpacking of the detector

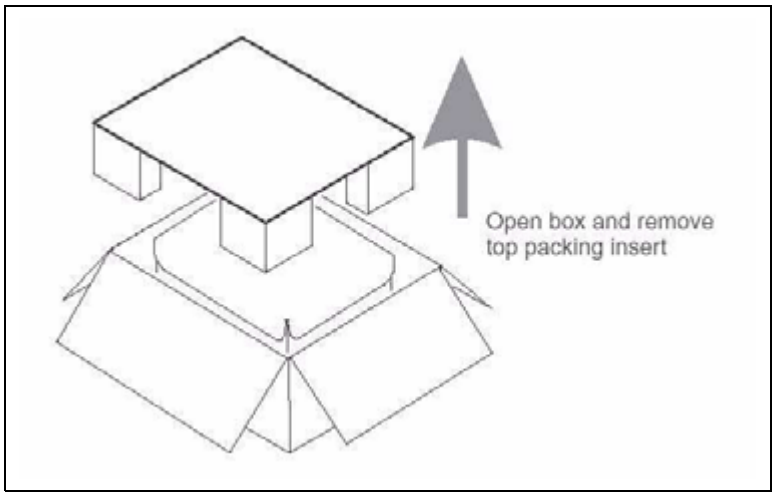


Fig. 6: Opening the cardboard box

1. Open the cardboard boxes and remove the top packing insert.

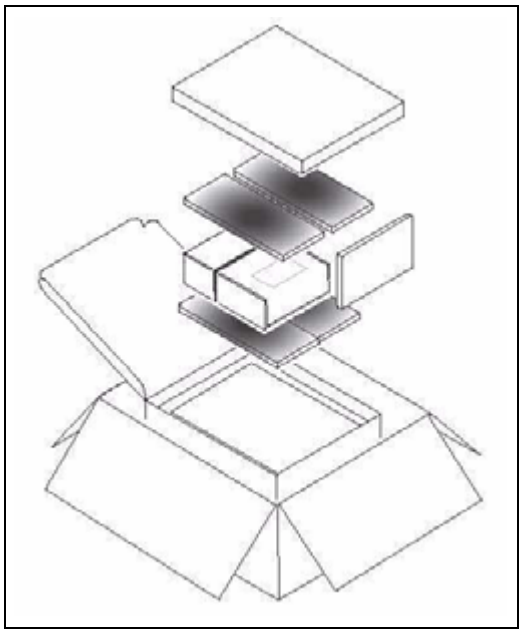


Fig. 7: Opening the box

2. Remove all of the other packing material covering the inner box in which the detector is located.

NOTE	Do not cut the lifting band.

Fig. 8: Lift out the inner box

3. Lift the inner box from the large box by pulling up on the lifting band.

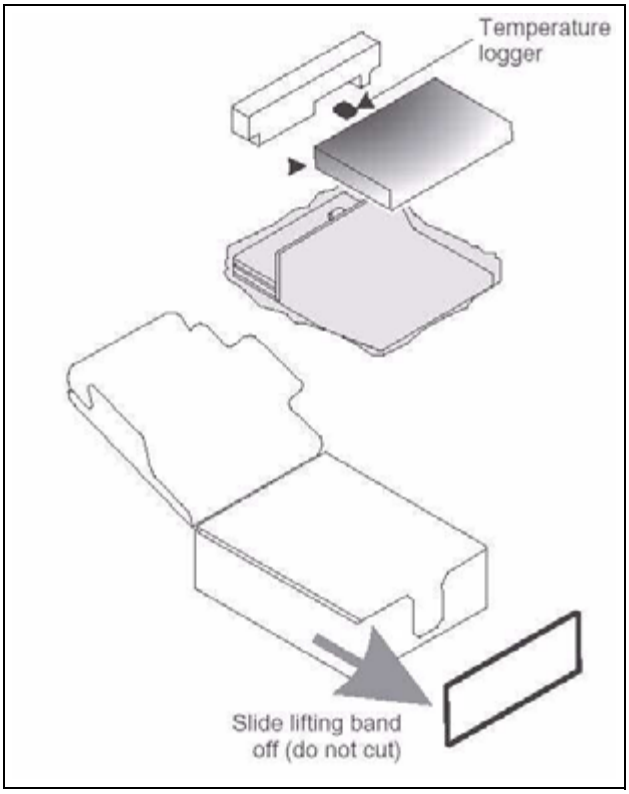


Fig. 9: Remove packing material

4. Slide the lifting band from the inner box.
5. Lift out the detector and carefully remove from wrapper.
6. Open box, remove packing insert, temperature logger and phase change material.
7. Remove the packing material inside the inner box, which includes the temperature logger that is used to ensure that the detector maintained the proper temperature while being shipped and stored.
8. Carefully remove the detector from its protective bag.

⚠CAUTION

Handle the detector with extreme care!

Any dust or fingerprints in this area may affect final image quality. Temperature extremes may cause permanent damage.

➪ **Avoid touching the thin film top cover that protects the imaging area. The imaging electronics under the front cover are extremely sensitive. The actual image area starts at the front edge and is approximately 25 mm inside the other three edges.**

9. Check the temperature logger with a ball pen, as shown in (Fig. 10 / p. 26).

Fig. 10: Check temperature logger

NOTE

A green LED indicates that the transportation was OK and the detector can be installed.

A red LED indicates that the detector is defective and has to be replaced.

NOTE

You have to send the temperature logger to the factory using the regular Customer Services return process.

You'll find all documents required for sending it enclosed in the detector package (black box).

Enter the detector serial number, your district address and installation date before you send it.

NOTE

The detector package has to be disposed of locally after the installation.

Mounting the detector

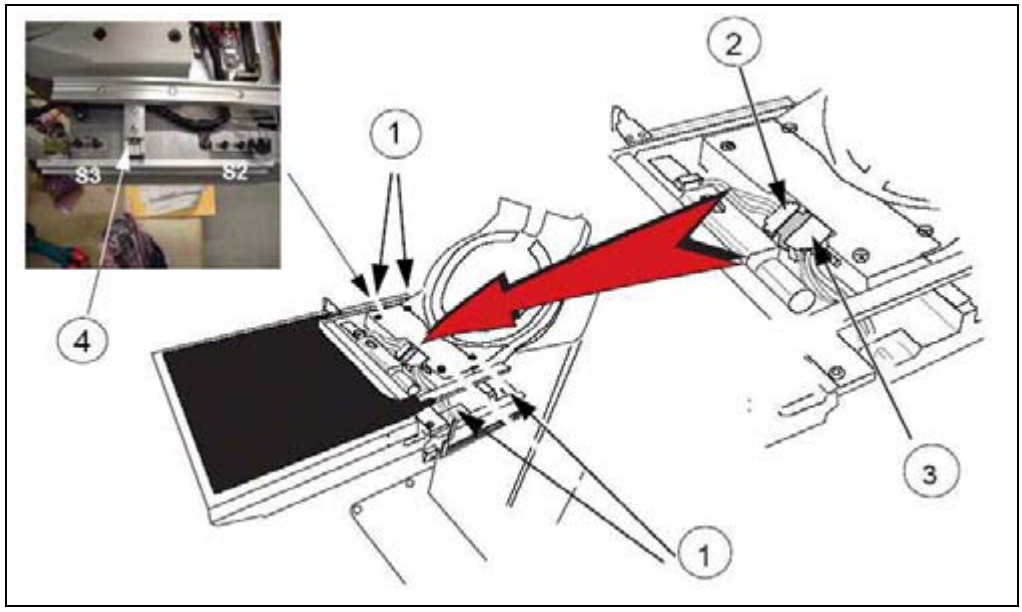


Fig. 11: Detector installation

1. Remove the micro switches and their holders S2 and S3.
2. Remove the cover from the detector cable connector.
3. Loosen the grid holder, 2 screws (4/Fig. 11 / p. 27).
4. Attach the detector with the four bolts (1/Fig. 11 / p. 27). Make sure that the bolts are tightened.

NOTE

To be sure that the detector is correctly mounted and that it is located directly below the radiation field, use the guiding lines on the wing and make sure that the detector is in the right position before screwing the bolts.

5. Insert the detector cable underneath the grid holder and tighten the grid holder screws again (4/Fig. 11 / p. 27).
6. Connect the detector cable (3/Fig. 11 / p. 27) to the cable coming out of the wing (2/Fig. 11 / p. 27).
7. Turn the actuating screw until it is finger-tight only. The remaining gap should not exceed 2mm.
8. Check that the pins on the connectors have not been pushed back.
9. Mount the cover over the detector cable with 2 screws. Make sure that no cables are squeezed.

Mounting the grid

The materials needed for the grid installation can be found in the accessory material box.

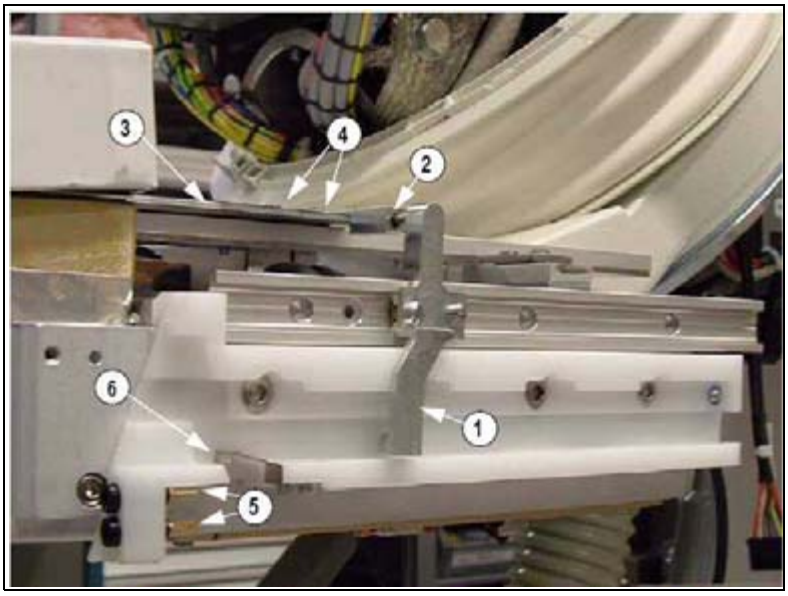


Fig. 12: Grid installation

1. Insert the left and right grid slider (1/Fig. 12 / p. 28) from the back into the rail.
2. Insert the left and right grid holder into the grid slider (2/Fig. 12 / p. 28).
3. Screw the grid (3/Fig. 12 / p. 28) to the grid holder (4/Fig. 12 / p. 28). The marking has to be on top, text must be readable.
4. Line up the grid so that it runs parallel to the front of the table; the front switch has to be engaged and the grid sliders have to be engaged with the spring (6/Fig. 12 / p. 28).

NOTE

Make sure that the grid sliders are locked in place and have only little play.

Make sure the springs move up and down easily.

5. Mount and dismount the MAG table several times and check if both grid holders (1/Fig. 12 / p. 28) are engaged with the spring (6/Fig. 12 / p. 28).

NOTE

The magnification table is optional. When the magnification is not supplied with the system, make sure that the grid is locked into the front of the table by the spring (6/Fig. 12 / p. 28).

6. Connect the (5/Fig. 12 / p. 28) cables for the magnification table on both sides according to the labels.

⚠WARNING

Fire hazard!

If not observed, the D805 will burn up.

➪ **Make sure that the cables are connected according to the labels.**

Adjusting the switches

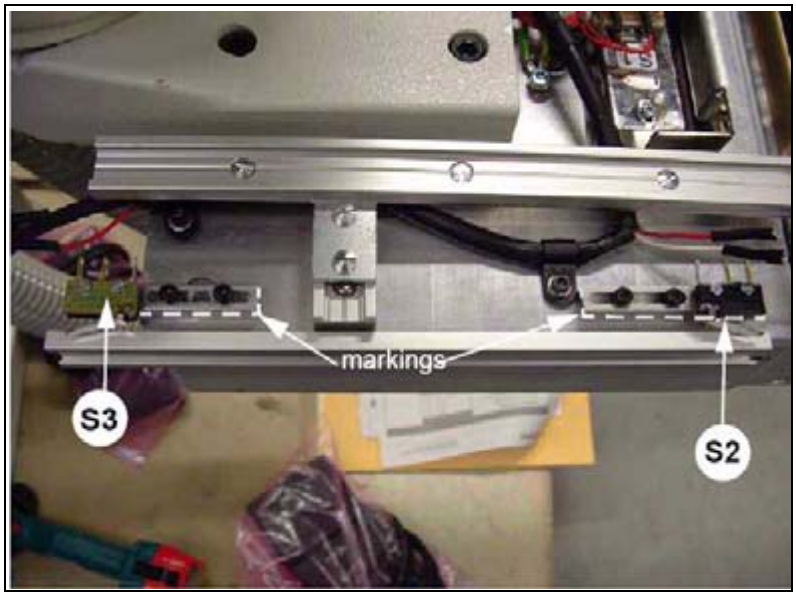


Fig. 13: Micro switch installation

1. Mount the micro switches S2 and S3 (Fig. 13 / p. 30) along the markings.
2. Adjustments of S2 move the grid to the front. S2 must switch 2 mm (+1 mm tolerance) before the grid reaches the end position.
3. Adjustment of S3 Move the grid to the back and insert the magnification table. S3 must switch 2 mm (+1 mm tolerance) before the magnification table reaches the end position.

NOTE

The magnification table is optional.

When no magnification is supplied with the system, the micro switch has to be mounted along the markings.

Remember to check the switch adjustment if the customer orders a magnification table.

Mounting the covers

1. Mount the top wing cover with **4 screws**.
2. Slide the detector fiber cover carefully over the detector and fasten it with 6 screws at the bottom of the cover.
3. Mount the bottom wing cover with 6 screws.

Mounting covers

Cable duct covers

If not already done, mount the cable duct covers.

Swivel arm covers

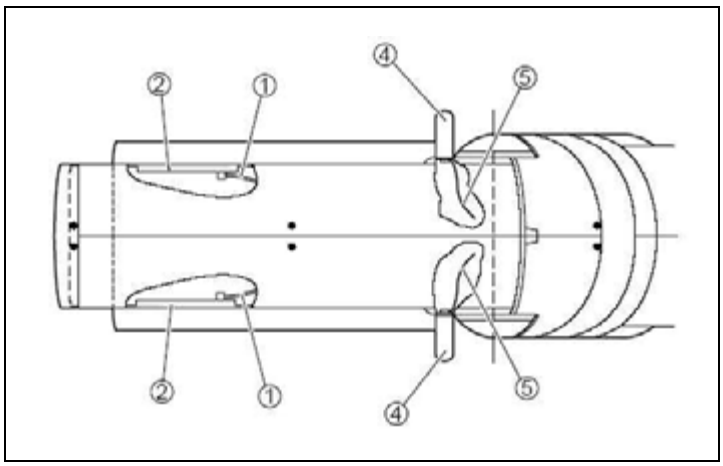


Fig. 14: Connecting the cables

Before installing the side covers, the cables have to be connected.

1. Connect cables X807 (1/Fig. 14 / p. 32) to control button circuit boards D807 (2/Fig. 14 / p. 32).
2. Connect ground wires (3/Fig. 14 / p. 32) to patient handles (4/Fig. 14 / p. 32).

Side cover

Screws in different sizes are included in the delivery.

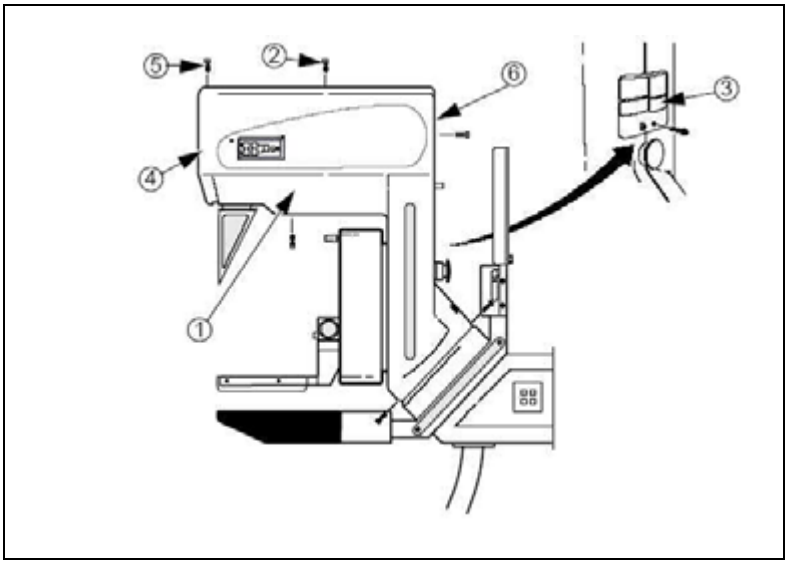


Fig. 15: Covers and sign

1. Mount the side covers (1/Fig. 15 / p. 33) with six screws (2/Fig. 15 / p. 33) on each side. Start with the right side.

NOTE

Do not forget to fit the sign when mounting the side covers (see (3/Fig. 15 / p. 33)).

Use the two longer screws.

NOTE

Make sure that the longer screws are not used at the back of the covers at the upper location since this may damage the board underneath the cover (see (6/Fig. 15 / p. 33)).

Front cover

⚠CAUTION

Risk of damages.

If the covers are exposed to internal stress, cracks might arise.

➪ **The following work must be carried out with caution.**

1. The side covers must be flush at the front. If necessary, loosen the screws and adjust the side covers.
2. Carefully fit the front cover (see (4/Fig. 15 / p. 33) so that both openings engage with the lugs of the side covers.
3. Carefully swing the front cover upwards and let it snap in position over the side covers.

⚠CAUTION

The front cover must not press against the collimator.

Risk of damage.

➪ **Be careful while attaching the front cover.**

4. Fasten the front cover to the side covers with two short screws (see (5/Fig. 15 / p. 33)).

Stand covers

⚠WARNING

The edges of the metal curtain on the stand are very sharp.

They may cause severe injury.

➪ **Remove the protective strips carefully when the covers are to be mounted. Store the strips in the holders provided on both sides of the curtain.**

NOTE

When mounting the stand covers, make sure that the screws at the top of the stand are securely tightened and have functioning contact washers.

These screws are used to establish protective ground connections.

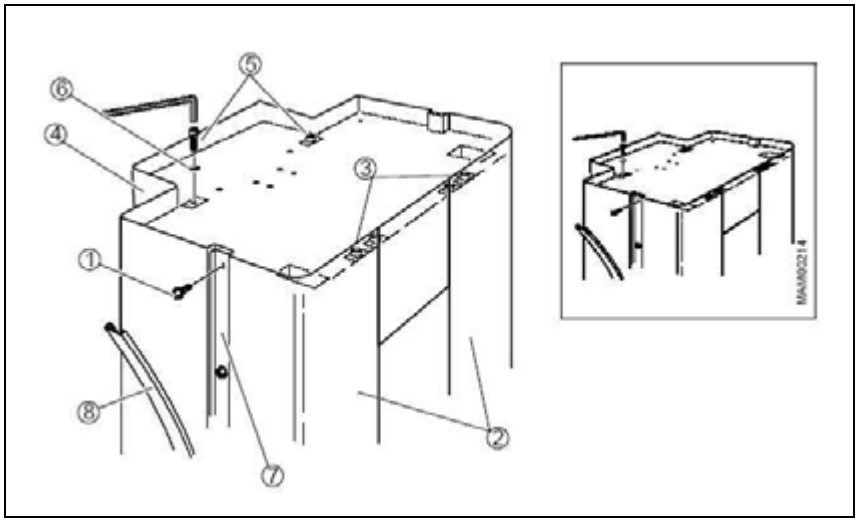


Fig. 16: Mounting the stand covers

1. The covers are delivered with a protective plastic film, which should be removed and discarded.
2. Make sure that clips are positioned over the holes where the screws (see (1/Fig. 16 / p. 34)) are to be fastened. These clips enable the screws to fasten the covers.
3. Fit left and right front covers (see (2/Fig. 16 / p. 34)) to the stand and fasten with screws and contact washers (see (3/Fig. 16 / p. 34)).

4. Fit the rear cover ((4/Fig. 16 / p. 34)) to the stand and fasten it with screws (see (5/Fig. 16 / p. 34)) and contact washers (see (6/Fig. 16 / p. 34)).

NOTE	**Be careful not to damage the cables at the cable outlet!**

5. Fit the inner plastic strip (see (7/Fig. 16 / p. 34)) to the front and side covers and fasten with screws (see (1/Fig. 16 / p. 34)), eight on either side.
6. Press on the outer plastic strip ((8/Fig. 16 / p. 34)).

Stand cap

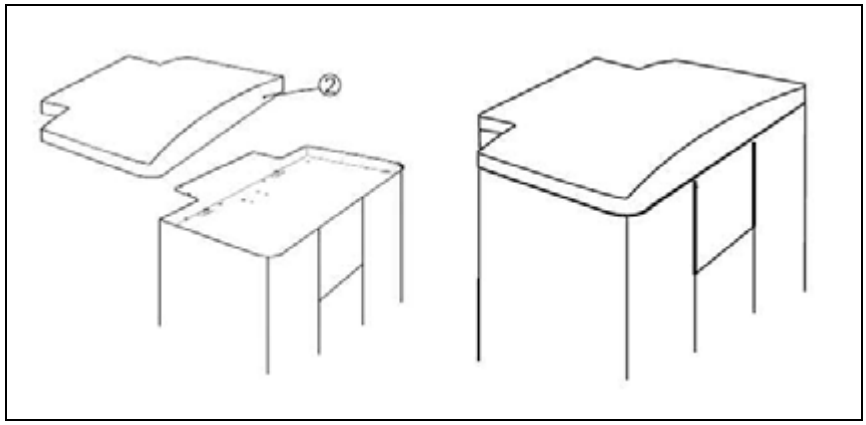


Fig. 17: Stand cap

1. Place the stand cap on the top of the MAMMOMAT stand (see (2/Fig. 17 / p. 35)).

Face shield

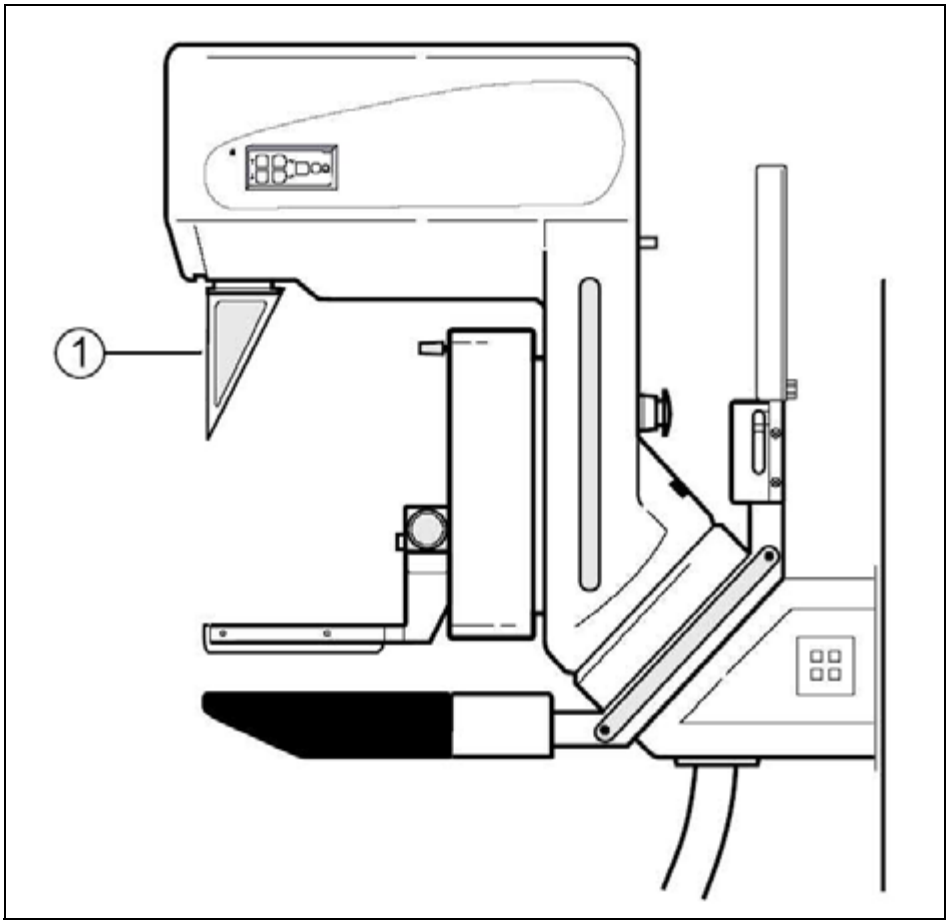


Fig. 18: face_shield

1. Slide the face shield (1/Fig. 18 / p. 36) onto the holder for external diaphragms. Checking the swivel arm system.

Mechanical Checks

Rotary motion

The rotary motion has to be checked with both wings.

1. System **OFF**.

   The rotary motion and the vertical adjustment of the swivel arm system should be blocked.

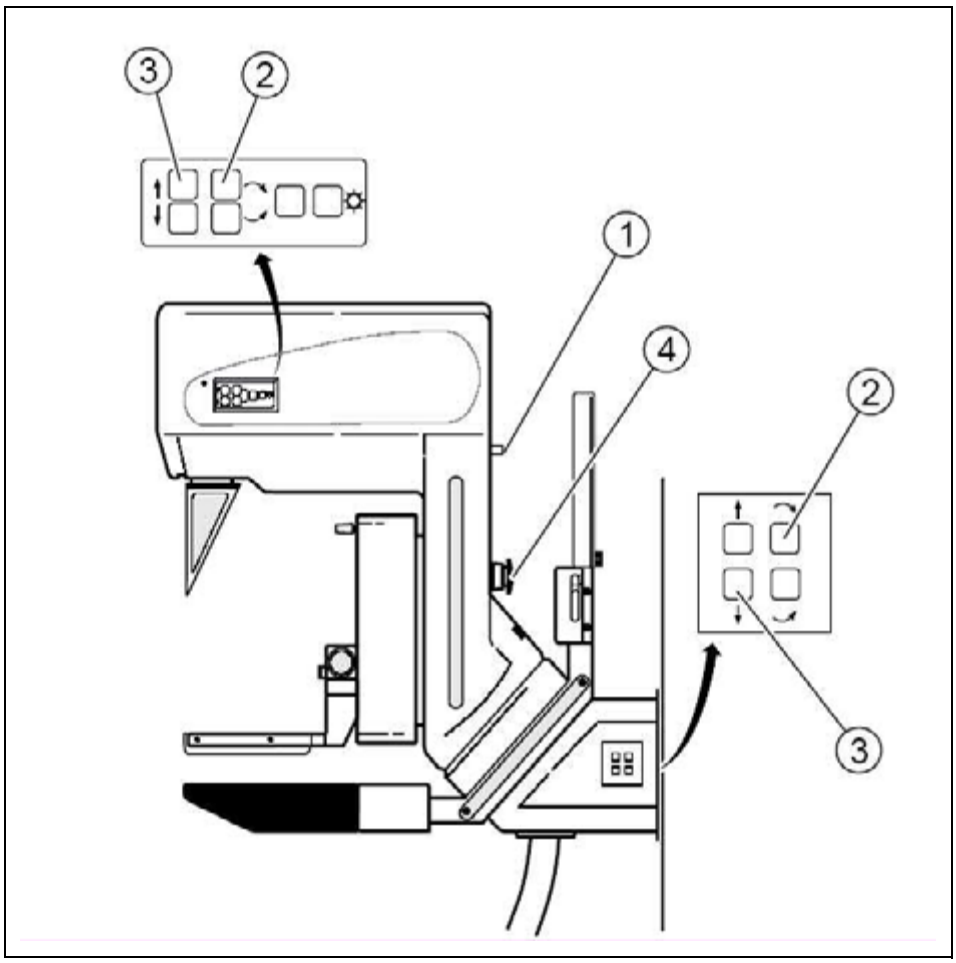


Fig. 19: swivel_arm_system

2. Turn the system **ON**.
3. Select the detector wing. **dr** is then displayed on the control console.
4. Set the projection angle set to minimum with the presetting knob (1/Fig. 19 / p. 37)

5. Check the rotary motion of the swivel arm system by pressing the buttons (2/Fig. 19 / p. 37) one by one.

   The rotation of the swivel arm system should stop when the button is released or when the end position is reached (**+135 degrees clockwise** and **-180 degrees counterclockwise**). The projection angle is shown on the display at the lower part of the stand.

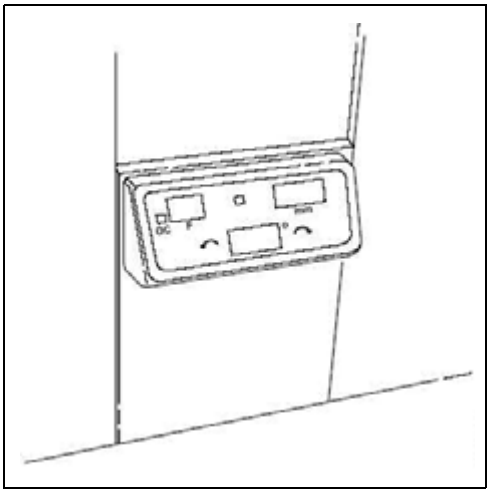


Fig. 20: Display at the lower part of the stand

6. Set the projection angle to **60 degrees** with the presettings knob (1/Fig. 19 / p. 37).

   The preset angle is displayed for approximately **3 s**.

7. Press one of the buttons (2/Fig. 19 / p. 37).

   The rotary motion of the swivel arm system should stop automatically when the preset projection angle (both + and -) is reached and at **0 degrees, +90 degrees or -90 degrees**.

NOTE

All eight rotary motion buttons (four on either side) must be checked.(2/Fig. 19 / p. 37)).

After the button has been released, the swivel arm system should remain in the position set.

OPDIMA wing

1. Select the OPDIMA wing; OP is then displayed on the control console.
2. Set the projection angle to minimum with presetting knob (1/Fig. 19 / p. 37).
3. Check the rotary motion of the swivel arm system by pressing the buttons (2/Fig. 19 / p. 37) one by one.

   The rotation of the swivel arm system should stop when the button is released or when the end position is reached (**+120 degrees clockwise** and **-120 degrees counterclockwise**). The projection angle is shown on the display at the lower part of the stand.

Vertical adjustment

⚠CAUTION

Remove the protective strips before performing the vertical adjustment of the swivel arm.

If not removed, the protective strips could be damaged.

➪ **Make sure the protective strips are removed before adjustments, see "Metal Curtain" on (Metal curtain / p. 12)**

1. Press the buttons for upward and downward movement ((3/Fig. 19 / p. 37)) of the swivel arm system.

   The movement should stop automatically when either the end position is reached or when the button is released.

NOTE

All eight vertical adjustment buttons (four on either side (3/Fig. 19 / p. 37)) must be checked.

The switching off in upper and lower end position is effected by switches S881 and S884 respectively.

Emergency stop

1. Press the emergency stop button (4/Fig. 19 / p. 37).

   The button should latch and all motorized movements of the equipment should be blocked ("Er 813" should appear). To reset the emergency stop button, turn it clockwise.

Checking the field light time

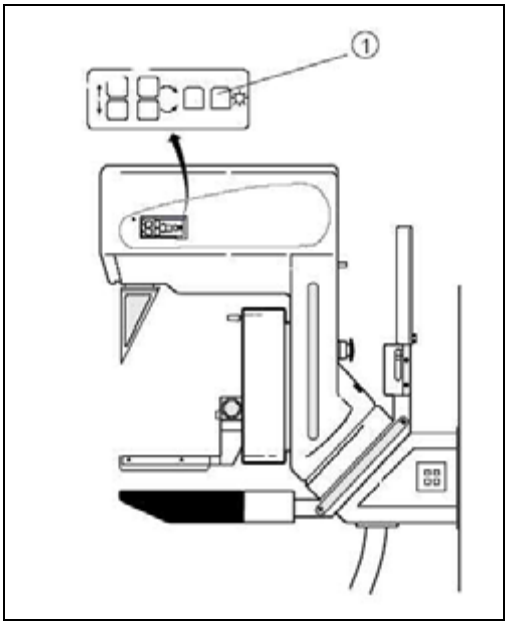


Fig. 21: Field light switch

1. Switch on the field light by pressing the switch (1/Fig. 21 / p. 40) or by pressing the compression foot switch (1/Fig. 22 / p. 40).

   The field light should go out automatically after a preset period of time (normally **20 s**.)

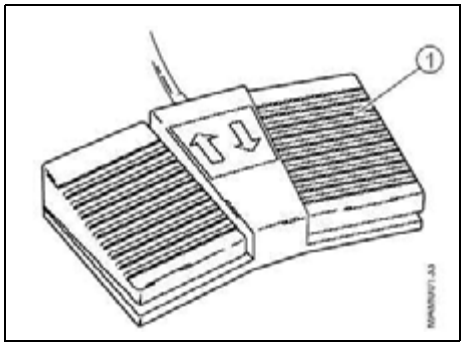


Fig. 22: Footswitch

Adjusting the field light time

The illumination time of the light field can be adjusted within a certain range according to the customer´s requirements.

NOTE **A shorter illumination time results in an increased lifetime of the lamp.**

1. Connect the service PC to the D750 and start the MAMMOMAT Service Software.
2. In the **Main menu** select **Configuration** -> **Miscellaneous** -> **Illumination time**.
3. Type in the illumination time and save with <**F2**>.

Checking the compression device

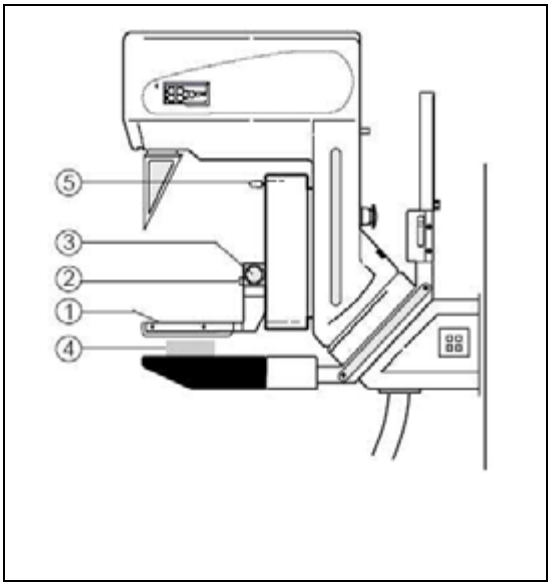


Fig. 23: Swivel arm system

1. Attach the compression plate (1/Fig. 23 / p. 41) if you have not already done so.
2. Check that the compression plate cannot be removed without pressing the compression plate release button (2/Fig. 23 / p. 41).
3. Check the function of the knobs for manual compression/decompression (3/Fig. 23 / p. 41).
4. Place a piece of soft material on the object table, for example a rolled up towel or a piece of foam rubber(4/Fig. 23 / p. 41).
5. Check the function of the foot switch for motorized compression/decompression (1/2/Fig. 24 / p. 41).

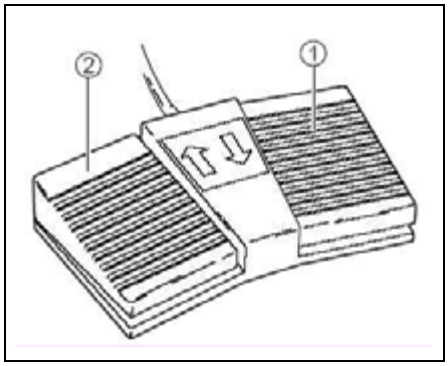


Fig. 24: Foot switch_2

6. Press the foot switch for motorized decompression to move the compression plate upwards while at the same time pressing the compression plate in the opposite direction by hand.

   The upward movement of the compression plate should now stop (safety switch).

7. Set the compression to **7 kg** by using the presetting knob (5/Fig. 23 / p. 41).

   The preset compression force is shown on the display at the lower part of the stand (1/Fig. 25 / p. 42).

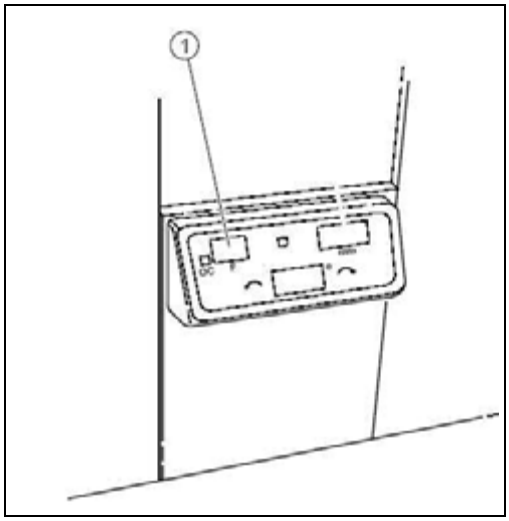


Fig. 25: Display at the lower part of the stand_2

8. Press the foot switch for motorized compression to move the compression plate downwards while simultaneously pressing the compression plate in the opposite direction by hand.

   The compression plate should now slow down and stop when the preset compression force is reached.

NOTE	**During compression, the motorized vertical adjustment and the rotary motion of the swivel arm system should be blocked.**

Decompression button

Check the decompression button on the separate control console for proper function, i.e. that the compression plate moves upwards when the button is pressed.

Checking the OPCOMP

1. Decompress.
2. Set the compression force to **20 kg** by using the presetting knob (5/Fig. 23 / p. 41) and compress.

   The compression movement must be interrupted by OPCOMP before **20 kg** is reached, i.e. at **5-15 kg** depending on the material (4/Fig. 23 / p. 41) used.

Adapting OPCOMP

If the factory-set OPCOMP is not to the customer's satisfaction, an adjustment can be carried out with the tautness factors in the **Optimized compression dr** table, see Service Instructions (**Software, SPB7-250.816.03...**). A lower tautness value will increase the compression force and vice versa.

- Increase/decrease the tautness factor by e.g. 10 the first time. Let the customer use this setting for at least two weeks before further changes are made.

NOTE	**OPCOMP has been thoroughly tested by Siemens. If any factors are changed, OPCOMP will no longer be an optimization of compression force and image quality according to Siemens' clinical test.**

Checking the exposure blocking

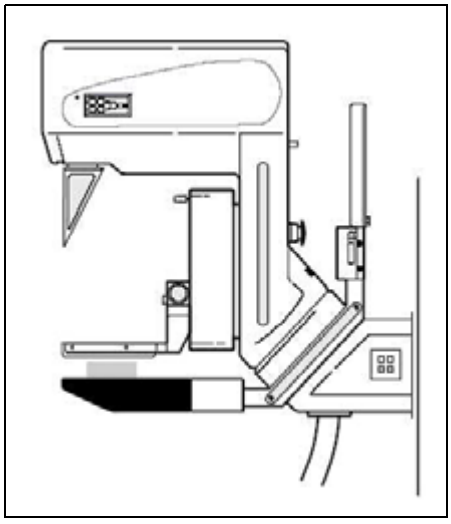


Fig. 26: Swivel arm system_2

Check that the exposure release is blocked during the following conditions:

- No patient is registered.
- No compression plate is mounted.
- The wing is not in position.

Tube high voltage, current and mAs values

This section describes how to check the X-ray tube in regard to the:

- High voltage, tube current, mAs value with and without AEC and with a small or large focus.

Preparation

- Switch the system **OFF**.
- Connect the oscilloscope as follows:

  Channel 1 to measuring point **HV_ACT (actual value)** (1 V= 5 kV) on the D750.

  Channel 2 to measuring point **MA_ACT (actual value)** (1 V= 40 mA) on the D750.
- Connect the service PC to the stand.
- Switch the system **ON**.
- Start the Service Program and check in the **anode menu** whether the tungsten anode is **enabled**.

Measurement method

- The mAs value must be calculated as the product of the tube current and exposure time. The tube current and the exposure time can be obtained from the oscillograms. The diagram may have glitches, in which case you have to measure the exposure time t1 and t2.

Example:

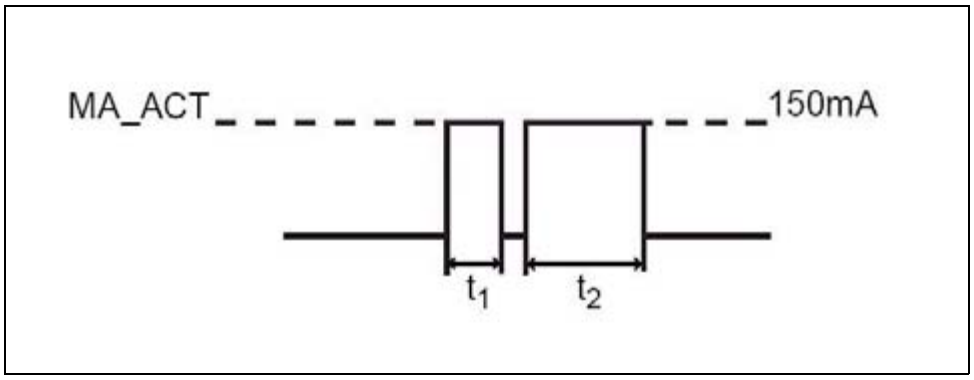


Fig. 27: Check x_ray tube high voltage _ current and mAs values

From the figure, the tube current is 150mA and the exposure time is t_1+t_2 in seconds. The mAs is 150mA*(t_1+t_2)

NOTE

Be aware that with the AEC mode on, a pre-exposure of 50 ms is done.

Select the correct trigger on the scope so you get the pre-exposure and all the exposure times.

Oscilloscope diagram examples

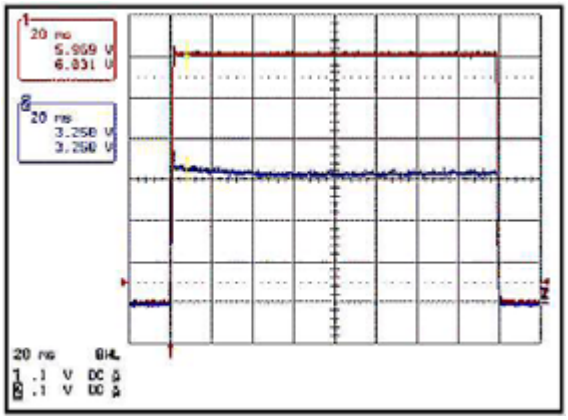


Fig. 28: diagram_30kV_20mAs_Mo_Mo

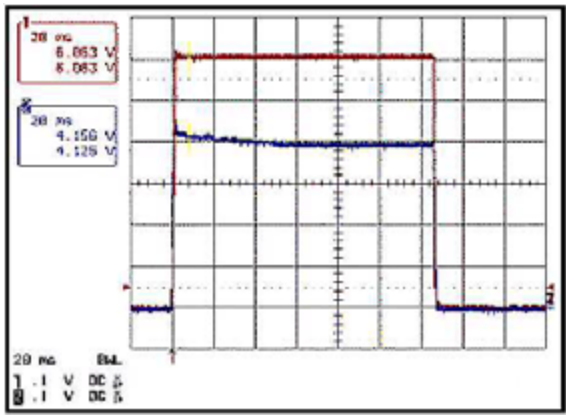


Fig. 29: diagram_30kV_20mAs_W_Rh

30 kV	1 V/T (1 T <=> 5 kV)		30 kV	1 V/T (1 T <=> 5 kV)
130 mA	1 V/T (1 T <=> 40 mA)		166 mA	1 V/T (1 T <=> 40 mA)
160 ms	20 ms/T		128 ms	20 ms/T

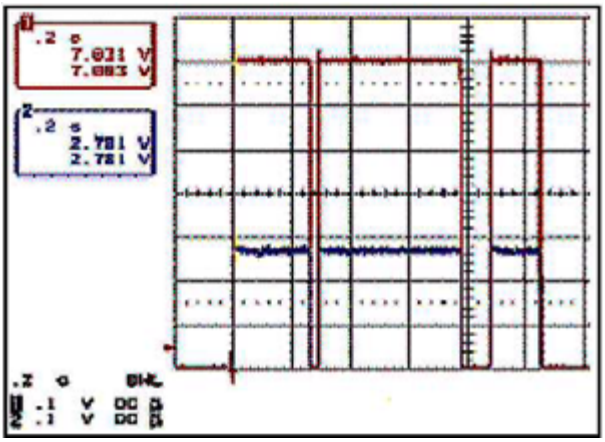


Fig. 30: diagram_30kV_100mAs_Mo_Mo

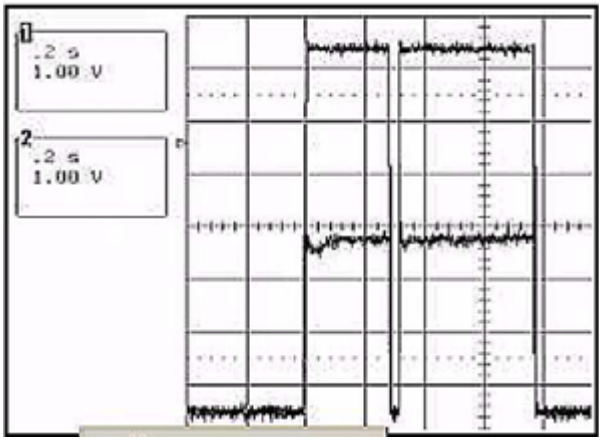


Fig. 31: diagram_30kV_100mAs_W_Rh

30 kV	1 V/T (1 T <=> 5 kV)	30 kV	1 V/T (1 T <=> 5 kV)
112 mA	1 V/T (1 T <=> 40 mA)	132 mA	1 V/T (1 T <=> 40 mA)
0.9 sec	0.2 s/T	0.72 sec	0.2 s/T

Checks with a large focus and without AEC

Prerequisites

- Deselect D and H on the control console, the MAMMOMAT is in mAs mode without AEC.
- Make sure the magnification table is removed so that a large focus is selected.
- The check has to be performed for each measurement of the table.

Tab. 7 Checks with a large focus and without AEC

Measurement	kV	mAs	Anode/Filter
1	30	20	Mo/Mo
2	30	20	W/Rh
3	35	100	Mo/Mo
4	35	100	W/Rh
5	25	100	Mo/Mo
6	25	100	W/Rh

- Cover the detector with the large steel plate or with a lead apron.

Test performance

1. Select the Examination tab card and load a patient for examination

NOTE

Depending on when a detector gain calibration was performed the last time, it may be required to be perform the detector gain calibration at this point. You may only then continue with these measurements. For more details on how to perform the gain calibration, see "Gain calibration", on (Gain calibration / p. 72).

2. Adjust the exposure value on the control console according to the table above.
3. Start an exposure.
4. Check and measure the kV value and the tube current characteristic on the oscilloscope.

   The accuracy of the kV is ± 5%, for tube current ±10% and for the mAs product ±10%.

5. Record the measured kV and mAs value in the "Start-up Protocol" on (Start-up Protocol / p. 97).
6. Change the setting and continue with the next measurement until you have completed all measurements from the table above.

Checks with a small focus and without AEC

NOTE

The magnification table is only shipped with the system when the customer had ordered this option.

Prerequisites

- Make sure the magnification table is mounted so that a small focus is selected.
- Deselect D and H on the control console; the MAMMOMAT is in mAs mode without AEC.
- The check has to be performed for each measurement of the table.

Tab. 8 Checks with a small focus and without AEC

Measurement	kV	mAs	Anode/Filter
1	30	10	Mo/Mo
2	30	10	W/Rh

- Cover the detector with the large steel plate or with a lead apron.

Test performance

1. Adjust the exposure value on the control console according to the table above.
2. Start an exposure.
3. Check and measure the kV value and the tube current characteristic on the oscilloscope. The accuracy of the kV is ±5%, for tube current ±10% and for the mAs product ±10%.

4. Record the measured kV and mAs value in the "Start-up Protocol" on (Start-up Protocol / p. 97).
5. Change the setting and continue with the next measurement until you have completed all measurements from the table above.

Checks with a large focus and with AEC

NOTE

Be aware that with the AEC mode on, a pre-exposure of 50 ms is done.

Select the correct trigger on the scope so you get the pre-exposure and all the exposure times.

Prerequisites

- Remove the lead apron from the detector.
- Mount the collimator mounted plexi phantom.
- Register a patient.
- Make sure the magnification table is removed so that a large focus is selected.
- Select H on the control console; the MAMMOMAT is in now in AEC mode.
- The check has to be performed for each measurement of the table.

Tab. 9 Checks with a large focus and with AEC

Measurement	kV	mAs	Anode/Filter
1	25	-	Mo/Mo
2	25	-	W/Rh

Test performance

1. Adjust the exposure value on the control console according to the table above.
2. Start an exposure.
3. Check and measure the kV value and the tube current characteristic on the oscilloscope. The accuracy of the kV is ±5%, for tube current ±10% and for the mAs product ±10%.

4. Record the measured kV and mAs value in the "Start-up Protocol" on (Start-up Protocol / p. 97).
5. Change the setting and continue with the next measurement until you have completed all measurements from the table above.

Automatic collimator

The automatic collimator unit limits the radiation/illumination field on the object table (detector) depending on the combination of the object table, compression paddle and focus.

At start-up or reset, a self-test is carried out to check that the collimator lamellae are moving in both directions, from their outer end positions (from now on called the reference position(s)) into and passing the positions for maximum collimation.

After the self-test has passed, collimation is carried out according to the combination of object table and compression paddle. During standby the collimation is always made to the focus of the field light bulb, i.e. to get the illumination field. This field will correspond to the radiation field during the exposure. When the exposure preparation is started, the collimator lamellae are adjusted to the currently selected anode focus, i.e. to get the radiation field.

Exposure will not be allowed as long as collimation is not ready or an invalid object table and compression paddle combination has been selected.

The maximum time to change the size of the field is 7s in standby and 1.9s when the initiation of the exposure preparation has been received. If the maximum time has elapsed, error 816 is generated.

Collimator reference axis

Collimator calibration is used to get the offset values to two reference axes, **y** and **x**.

- The **y-axis** is orthogonal to the chest wall side edge in the center of the object table.
- The **x-axis** is located at the object table chest wall side edge.

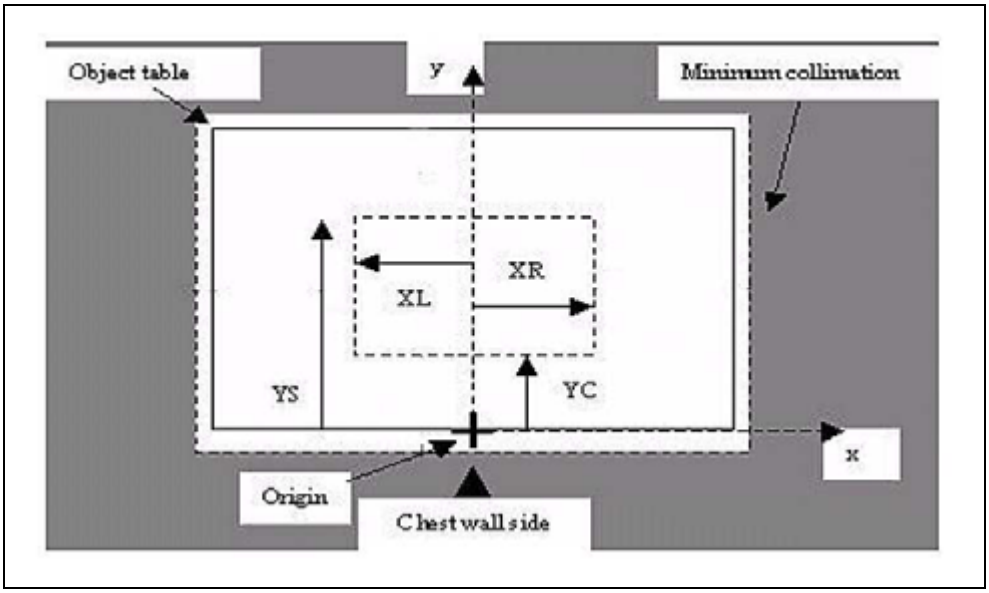


Fig. 32: Collimator calibrations

- Moving the collimator **OUT** is done by **INCREASING** the **YC** value and **DECREASING** the **YS**, **XL** and **XR** values.

- Moving the collimator **IN** is done by **DECREASING** the **YC** value and **INCREASING** the **YS**, **XL**, and **XR** values.

Collimator beam check and calibration

You have to perform the collimator beam check with the **detector wing** for all **focus & anode** combinations.

1. Make sure that a patient is registered.
2. Select the **detector wing. dr** is then displayed on the control console.
3. Mount the Collimator Mounted Phantom.
4. Connect the compression simulator.
5. Select **25 kV** and **50 mAs** on the control console.

6. Start an exposure.
7. View the image with a magnification of 4.
8. Slide the magnification glass along the image edges of the image and check if white lines are visible.

NOTE

If you do not see white lines at the edges of the image, the collimator beam calibration is correct and you can continue with the "Collimator field light calibration" on (Collimator field light calibration / p. 52).

Otherwise continue with the "Collimator beam calibration" on (Collimator beam calibration / p. 50)

Collimator beam calibration

Collimator for the collimator beam is carried out as follows:

1. Make sure that the **detector wing** is selected. **dr** is then displayed on the control console.
2. Connect the compression plate simulator and the collimator mounted plexi phantom.
3. Connect the service PC to the MAMMOMAT stand and start the service software.

4. Select

   Configuration -> Collimator -> Calibration of beam field

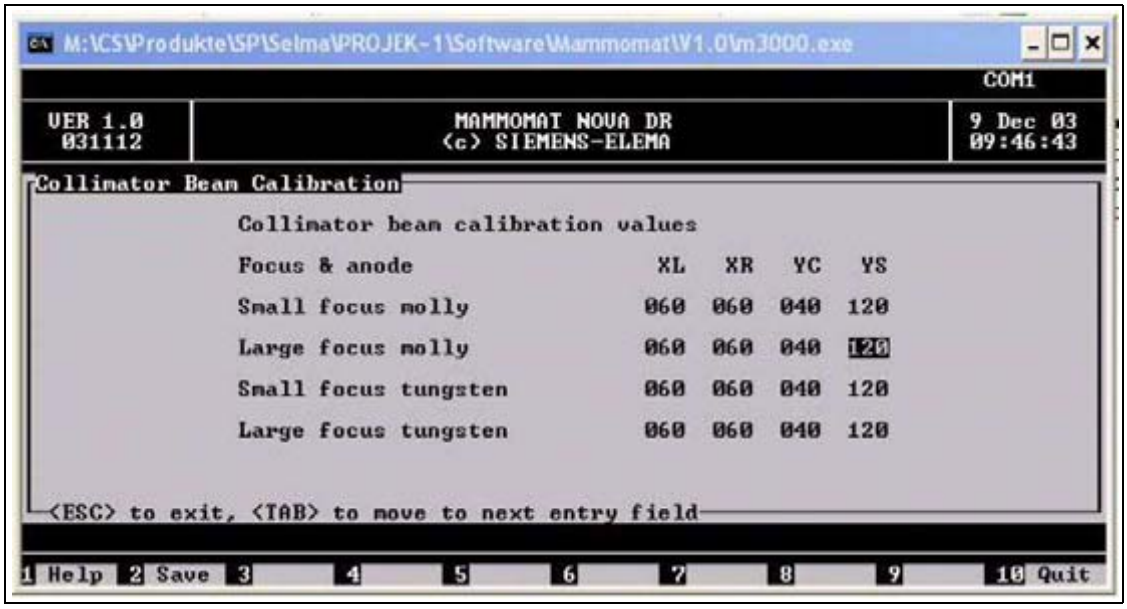

M:\CS\Produkte\SP\Selma\PROJEK-1\Software\Mammomat\V1.0\m3000.exe
COM1
VER 1.0
031112
MAMMOMAT NOVA DR
(c) SIEMENS-ELEMA
9 Dec 03
09:46:43
Collimator Beam Calibration
Collimator beam calibration values
Focus & anode XL XR YC YS
Small focus molly 060 060 040 120
Large focus molly 060 060 040 120
Small focus tungsten 060 060 040 120
Large focus tungsten 060 060 040 120
<ESC> to exit, <TAB> to move to next entry field
1 Help 2 Save 3 4 5 6 7 8 9 10 Quit

Fig. 33: Collimator beam calibration

5. Enter the numbers in the table below so that you always know what settings were used in the beginning:

Tab. 10 Collimator beam calibration

Focus and Anode	XL	XR	YC	YS
Small focus molly				
Large focus molly				
Small focus tungsten				
Large focus tungsten				

6. Narrow the X-ray field so that the edges of the detector will not be exposed to X-ray and white lines are visible in the image at the edges of the detector. To do so, decrease the **YC** value and increase the **YS, XR** and **XL** values by **5** numbers.
7. Select a **focus & anode** combination.
8. Make sure a patient is registered and start an exposure.
9. Use a magnification of **4** in the application software and go to the edges of the detector. White areas should be visible at all edges of the image. This shows you that the X-ray does not cover the entire detector and shows where the beam really ends.
10. Measure the white line thickness at each image edge with the application GUI and adjust the corresponding **XL, XR, YC** and **YS** values with the service software.

11. Start an exposure.
12. Check if the while lines at the edges of the image are gone, using a magnification of **4** in the application graphical user interface.

13. Repeat the procedure for **all focus & anode** combinations until all white lines at the image edges are gone.
14. **Save** the calibration and **Exit** from the service software.

NOTE

If you see a white thin line on the chest wall when using the magnification table, it might be the magnification table itself. Pull the magnification table out by approximately 1 mm and try again.

15. Record the measured values in the "Start-up Protocol" on (Start-up Protocol / p. 97).

Collimator field light calibration

Calibration for the field light is carried out as follows:

1. Select the detector wing. dr is then displayed on the control console.
2. Start the service software on the service PC and select:

   Configuration -> Collimator -> Calibration of light field

Fig. 34: Collimator light calibration

3. Position the X-ray cross in the center of the detector.
4. Make sure that a patient is registered.
5. Mount the Collimator Mounted Phantom.
6. Mount the compression simulator.
7. Deselect **H** and **D** on the control console by selecting **25 kV** and **50 mAs** on the control console.
8. Start an exposure.
9. Compare the image with the reading of the X-ray cross on the detector when the light field is turned on.
10. Adjust the difference with the service software.
11. Continue with Step 7 until the beam field and light field are identical.
12. **Save** the calibration and **Exit** the service software.

13. Record the measured values in the **"Start-up Protocol"** on (Start-up Protocol / p. 97).

Collimator Wing Difference Calibration

The collimator wing difference calibration has to be adjusted

NOTE

If no precise wing difference calculation is performed, or if you have to start from scratch, you can start with the "large focus/molly" values that have been adjusted with the "Collimator beam calibration" on (Collimator beam calibration / p. 50).

1. Select the **OPDIMA wing** by moving the detector into the park position. **OP** is then displayed on the control console.
2. Connect the compression plate simulator and the collimator-mounted plexi phantom.
3. Start the service software on the service PC and select:

   Configuration -> Collimator -> Calibration of wing difference

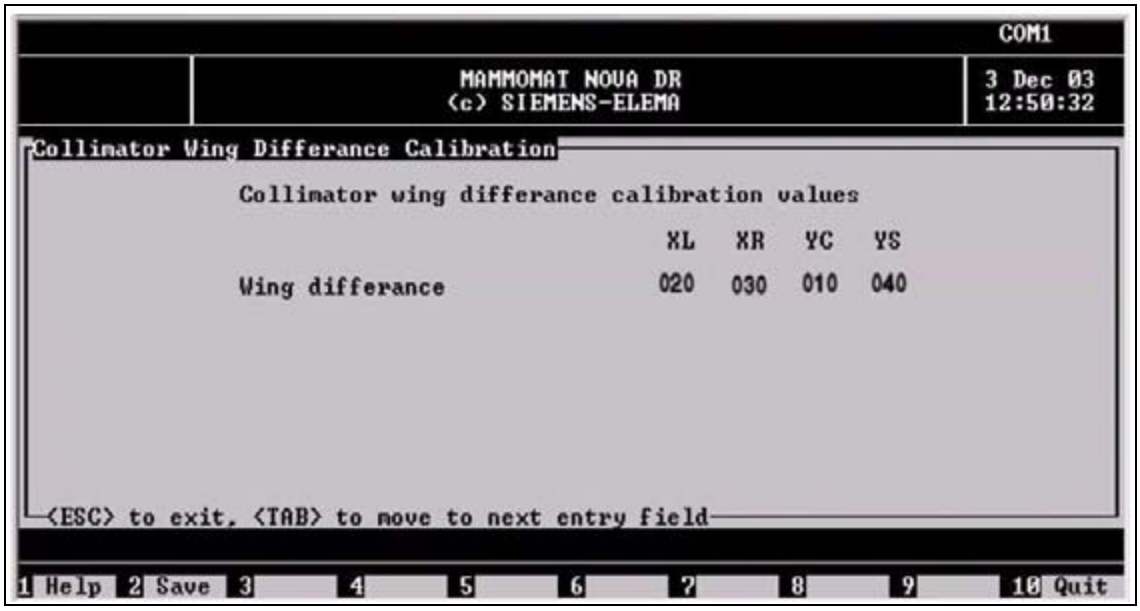

COM1
MAMMOMAT NOVA DR
(c) SIEMENS-ELEMA
3 Dec 03
12:50:32
Collimator Wing Difference Calibration
Collimator wing difference calibration values
XL XR YC YS
Wing difference 020 030 010 040
<ESC> to exit, <TAB> to move to next entry field
1 Help 2 Save 3 4 5 6 7 8 9 10 Quit

Fig. 35: Collimator wing difference calibration

4. Enter the numbers in the table below:

Tab. 11 Wing difference

Focus and Anode	XL	XR	YC	YS
Wing difference				

5. Narrow the X-ray field so that the edges of the detector will not be exposed to the X-ray and white lines are visible in the image at the edges of the detector. To do this, decrease the YC value and increase the **YS**, **XR** and **XL** values by **5** numbers.
6. Make sure a patient is registered and start an exposure.

7. Use a magnification of **4** in the application software and go to the edges of the detector. White areas should be visible at all edges of the image. This shows you that the X-ray does not cover the entire detector and shows where the beam really ends.
8. Measure the white line thickness at each image edge with the application graphical user interface and adjust the corresponding **XL**, **XR**, **YC** and **YS** values with the service software.

9. Start an exposure.
10. Check if the white lines at the edges of the image are gone using a magnification of **4** in the application graphical user interface.
11. **Save** the calibration and **Exit** from the Service Software

NOTE	**If you see a white thin line on the chest wall when using the magnification table, it might be the magnification table itself. Move the magnification table out by approximately 1 mm and try again.**

12. Record the measured values in the "Start-up Protocol" on (Start-up Protocol / p. 97).

Enable/Disable Dose Calculation

If desired, the Dose Calculation System can be enabled/disabled. The Dose Calculation System is **enabled** by default.

This is done by starting the Dose Calculation Program in the service PC.

From the **Main menu** in the Service program choose:

Configuration ⇒ **Dose Calculation** ⇒ **Enable/Disable Dose Calculation**.

To show the calculated dose values on the control console, **enable** this option (ON).

The dose will be shown in the mAs/mGy display ((Fig. 36 / p. 55)); the value shown will shift from mAs to dose within approximately 2 seconds.

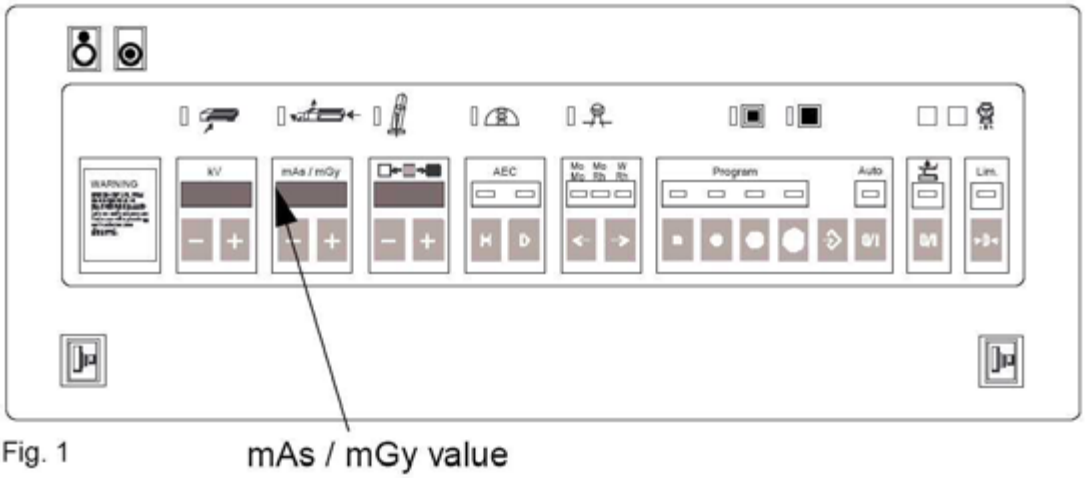


Fig. 36: mAs_mGy_value

NOTE	**Selecting "OFF" will only prevent dose values from showing in the mAs/mGy display. Dose calculations will still be performed and can be printed out if the printer option is installed.**

Configuring of Dose Calculation System

The Dose Calculation System comes with factory default values. The factory default values should typically be used. If desired, measurements of HVL (Half Value Layer) and dose exchange factors can be performed to improve the accuracy of displayed dose values. These measurements should be performed by the hospital's medical physicist and are described in the document "**QC Manual, SPB7-250.623.xx..., Test Beam Quality**". The measuring procedure is quite complicated and should only be performed by a physicist familiar with similar measurements. If the HVL and dose exchange values are to be measured, the document **"Software, SPB7-250.816.03..."** describes how to enter the values in the Dose Calculation Program.

If reinstalling factory default parameters, all previously entered measured data (HVL values and dose exchange factors) will be lost. However, the measured data should already be noted in the document **"QC Manual"**.

Label

If the Dose Calculation System is enabled, affix a mAs / mGy label over the "**mAs**" text on the control and display panel. The label is found in tab 3 of the Technical Manual binder.

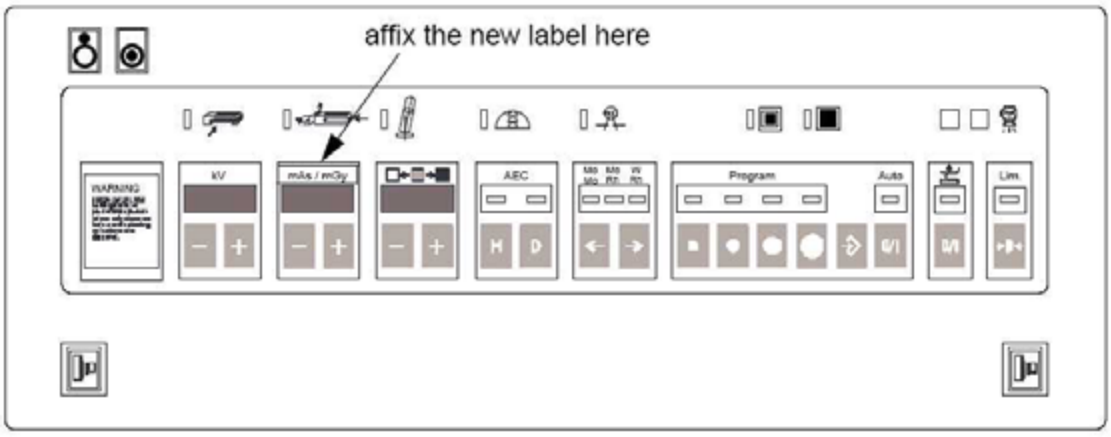


Fig. 37: Label

Checking OPDOSE

The OPDOSE values are checked in this chapter.

In AUTO mode the system suggests an appropriate program (kV, Anode/Filter combination) corresponding to a specific breast thickness. The new, suggested program is indicated by a blinking LED, whereas the previously used program is shown by a continuously lighted LED.

Please see **the Instructions of Use** (SPB7-250.620.01...) for the correct OPDOSE values.

Changes can be made with the MAMMOMAT stand service software:

Configuration -> Miscellaneous -> Auto limits.

A special setting can be stored for each wing, thus the measurement has to be performed for the **detector wing** and the **OPDIMA wing**.

Proceed as follows for the "detector wing":

1. Select the **detector wing. dr** is then displayed on the control console.
2. Mount a 18x24 cm compression plate.
3. Select a thickness of calibration plexi (part no. 65 61 240) that is within the thickness interval of the program to be tested.
4. Select **AUTO** on the control panel.
5. Place the calibration plexi on the object table and compress to 6 kg or more.
6. Check that the correct program is blinking on the control panel. Select the program by pressing the corresponding program button on the control panel.
7. Repeat the procedure described in **steps 3-6** for the other programs used.
8. ✍ Record the measured values in the "**Installation Protocol**" (SPB7-250.813.01...).

Proceed as follows for the “OPDIMA wing”:

1. Select the **OPDIMA wing**. As a result, **OP** is displayed on the control console.
2. Mount the **spot 1.0** compression plate.
3. Select a thickness of calibration plexi (part no. 65 61 240) that is within the thickness interval of the program to be tested.
4. Select **AUTO** on the control panel.
5. Place the calibration plexi on the object table and compress to 6 kg or more.
6. Check that the correct program is blinking on the control panel. Select the program by pressing the corresponding program button on the control panel.
7. Repeat the procedure described in **steps 3-6** for the other programs used.
8. ✍ Record the measured values in the "Start-up Protocol" on (Start-up Protocol / p. 97).

Checking the AEC dose settings

The dose values for the AEC settings (**H & D** selection on the control console) have to be checked.

As a default from the factory, the following **BRICK / AEC Configuration** values are set (for further details see the **Software Brick V...** manual SPB7-250.816.04...):

- **H = (80, 70, 45)**
- **D = (100, 80, 60)**

Checking the H & D dose settings for Mo/Mo.

Proceed as follows:

1. Mount the collimator mounted plexi phantom and the compression plate simulator.
2. Register or create a patient and submit with **Exam**.

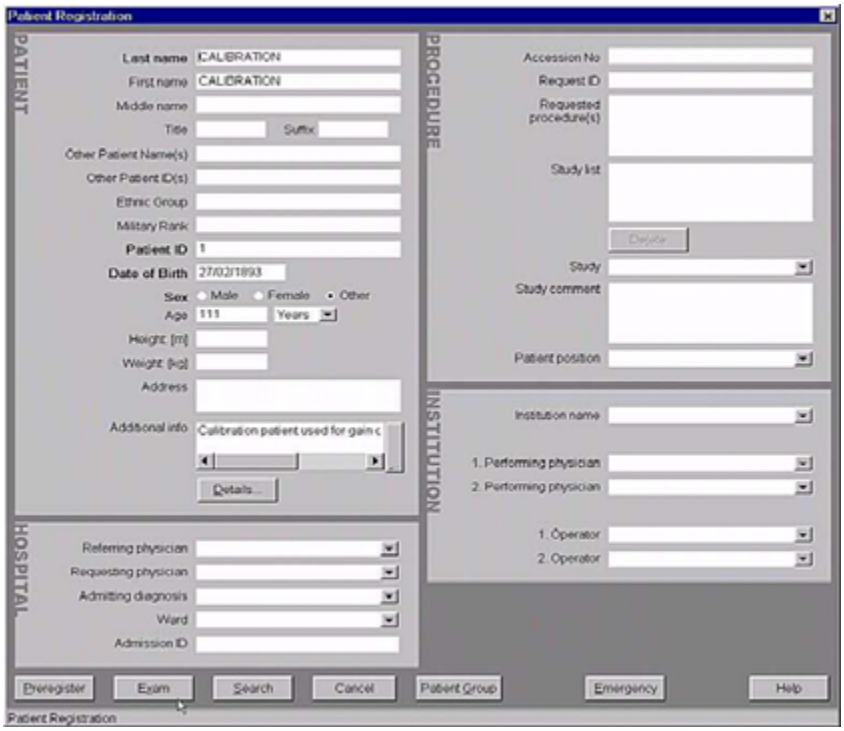


Fig. 38: Calibration_Patient register

3. Select the Procedure **QC-Raw** from the examination tab card.

Fig. 39: select procedure

NOTE

Remember, you can always add or remove images to the "Procedure" by right-clicking the mouse.

4. Select the appropriate exposure parameters according to the table

Tab. 12 Checking H & D dose settings for Mo/Mo

AEC	kV	Anode / Filter	Dose Value	Pixel Value
H	28 kV	Mo/Mo		
D	28 kV	Mo/Mo		

5. Position the dose meter probe 6 cm from the chest wall and 3 cm off the center of the detector.

NOTE

If parts of the meter probe cover the AEC sensor, one will get a higher dose.

Thus, make sure that the probe is not covering the AEC sensors. This can be checked with the mounted compression plate. The AEC sensors are drawn on the compression plate.

6. Start an exposure.

7. Measure the following values and add them to the table at step 4:

   - **dose value** in the table above. The measured AEC dose values must be between:

   H -> 120 µGy to 140 µGy

   D -> 180 µGy to 200 µGy

   - image **pixel mean value**

   Display the image with the **syngo Image Viewer**. To do so, click the **Viewing** tab card, load the image with the **Patient -> Browser** and select **Tools -> Rectangle**. Draw an area of approximately **1 sq.cm** and measure the pixel mean value. You have to measure approximately **2 cm** above the chest wall at the center of the detector.

   Criteria: The expected pixel mean values are:

   H = 250 350

   D = 300 400

8. If the **H & D** dose settings have to be adjusted, proceed with Chapter 8 "Adjust the H and D Settings" and repeat the H & D dose check for Mo/Mo again.

✍ 9. Record the measured values in the "Start-up Protocol" on (Start-up Protocol / p. 97).

Check the H & D dose settings for Mo/Rh and W/Rh.

If the Mo/Mo AEC dose values for **H & D** are within the specification, proceed as follows:

1. Mount the collimator mounted plexi phantom.
2. Select the appropriate exposure parameters according to the table and start an exposure.
3. Select the anode/filter combination according to the table and set the mAs (control console) as close as possible to the H & D mAs values (Mo/Mo) that you have measured in step 2.

   Display the image with the **syngo Image Viewer**. To do so, click the **Viewing** tab card, load the image with the **Patient -> Browser** and select **Tools -> Rectangle**. Draw an area of approximately **1 sq.cm** and measure the pixel mean value.

   Add the result to the table.

Tab. 13 Checking the H & D dose settings for Mo/Rh and W/Rh

Anode / Filter	AEC	kV	Pixel value
Mo/Rh	H	28 kV	
	D	28 kV	
W/Rh	H	28 kV	
	D	28 kV	

The Mo/Rh and W/Rh pixel values must be as close as possible to the Mo/Mo pixel values (see table at step 2).

The deviation must not exceed +/- 20 %.

4. If the **H & D** dose settings have to be adjusted, proceed with Chapter 8 "Adjust the H and D Settings" and repeat the **H & D** dose checks for Mo/Rh and W/Rh again.

✍ 5. Record the measured values in the "**Start-up Protocol**" on (Start-up Protocol / p. 97).

Adjust the H and D Settings

To adjust the

H value, go to **Modify low dose scaling** (80, 70, 45) and

D value, go to **Modify high dose scaling** (100, 80, 60) and

enter the new values, separated by a comma, e.g. **100,80,60.** The values represent the factor in % for (Mo/Mo, Mo/Rh, W/Rh).

Three settings, e.g. **try** (short-term, is valid for one measurement only), **save** (long-term, valid also after reboot) and **load** (effective, valid until the system is rebooted) can be used in the drop-down menu above the values.

To change the values permanently, enter the correct values and select **save**, then use **load** to load them before you start another exposure.

--> **Calculation of the new Mo/Mo dose scaling value:**

$$NewScalingValue = OldScalingValue * DoseValue_{Nominal} / DoseValue_{Measured}$$

$DoseValue_{Nominal}$ for H = 130 µGy

$DoseValue_{Nominal}$ for D = 190 µGy

--> **Calculation of the new Mo/Rh, W/Rh dose scaling values:**

$$NewScalingValue = OldScalingValue * PixelValue_{Mo/Mo} / PixelValue_{Measured}$$

--> **Proceed as follows:**

1. Call up the service software and select:

   Acquisition System -> BRICK Configuration

   The BRICK service software opens another window.
2. Select **Brick -> AEC Configuration**.
3. The BRICK software switches to a higher user level, thus a Username and Password have to be entered.

   User name: **root**

   Password: ******

4. Click **Modify settings**.

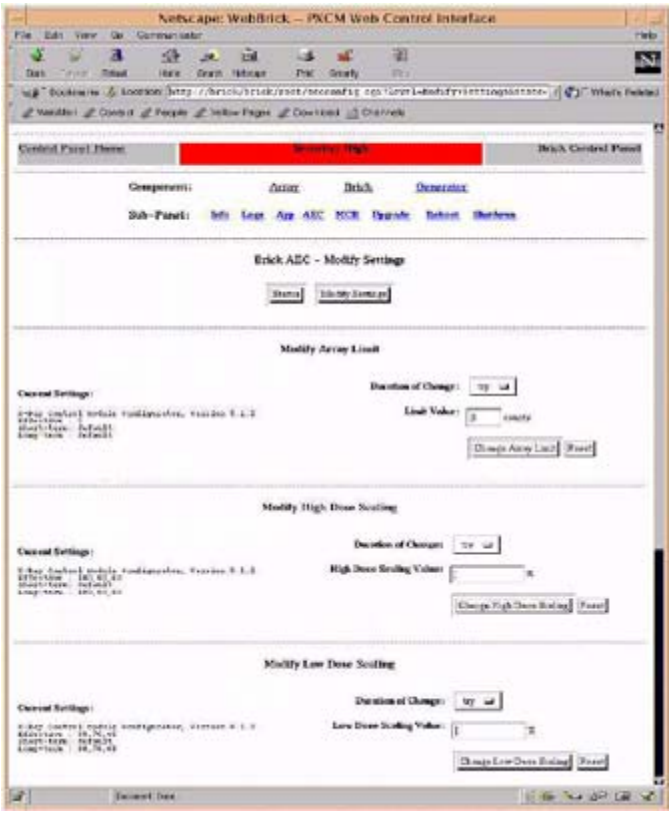

Netscape: WebBrick – PXCM Web Control Interface
Brick ASC - Modify Settings
Modify Array Limit
Modify High Dose Scaling
Modify Low Dose Scaling

Fig. 40: BRICK_Modify settings

5. To adjust the

   - **H** value,

   go to **Modify low dose scaling** (The default values are 80, 70, 45) and enter the new values, separated by a comma, e.g. **80,70,45** in the **Low Dose Scaling Value** field and click **Change Low Dose Scaling** to save it.

   - **D** value,

   go to **Modify high dose scaling** (The default values are 100, 80, 60) and enter the new values, separated by a comma, e.g. **100,80,60** in the **High Dose Scaling Value** field and click **Change High Dose Scaling** to save it.

6. Proceed from where you were originally referenced.

Checking Grid Lines

This chapter contains:

1. “Checking visibility of grid lines” on (Checking visibility of grid lines / p. 63).
2. "Measuring grid lines" on (Measuring grid lines / p. 65).

   If grid lines are visible in one or more images, the grade of grid lines must be measured. The criteria for the **mean pixel value difference** of the visible grid lines is less than 1%.
3. "Eliminating Grid lines" on (Eliminating grid lines / p. 66).

Preconditions

- The system is up and running.
- The operator is logged in to the system.
- The compression plate simulator is mounted on the MAMMOMAT.

Checking visibility of grid lines

1. Register or create a patient **Grid lines test** and submit with **Exam**.

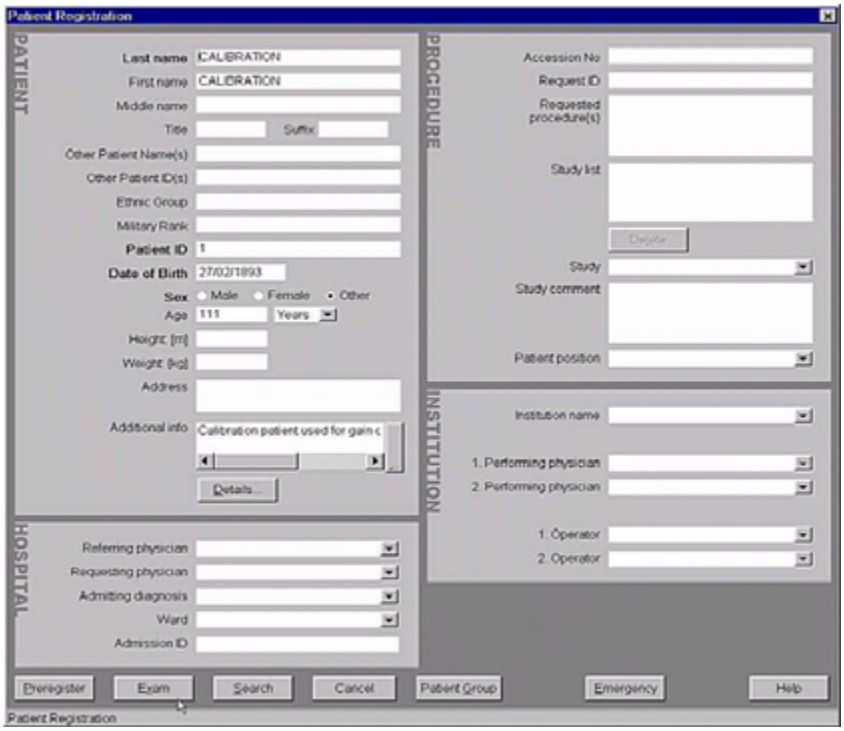


Fig. 41: Calibration_Patient register

2. Select the Procedure **VendorProc 1** from the examination tab card.

Fig. 42: Select procedure for grid line test

NOTE	**Remember you can always add or remove images to the "Procedure" by right-clicking the mouse.**

3. Select the exposure parameters: **28 kV** and **Mo/Mo**.
4. Make sure that a 1 : 1 view is selected to have a better view.

   Select **View -> a 1:1**
5. Make all exposures according to Tab. 1.
6. Activate magnification **(Image -> Magnify by 2.0)** and look for grid lines over the plexi phantom area.
7. Make a not of the results (visible grid lines) in Tab. 1; choose the next image in the list and start over with step 5 until all images are evaluated.

Test 1 protocol

Tab. 14 Checking the visibility of grid lines

Exposure	Exp Mode	mAs	PMMA / mm	Tube Angle	Visible grid lines (yes/no)
1	mAs	32	30	0^o	
2	mAs	56	40	0^o	
3	mAs	110	50	0^o	

Exposure	Exp Mode	mAs	PMMA / mm	Tube Angle	Visible grid lines (yes/no)
4	AEC “H”	-	40	0°	
5	AEC “H”	-	40	+ 60°	
6	AEC “H”	-	40	- 60°	

Test Criteria

The test will pass if **no** grid lines are visible in all images.

If grid lines are visible

- continue with “Measuring grid lines” on (Measuring grid lines / p. 65) on the image(s) that didn‘t pass.

Otherwise

-

✍ Record the measured value in the **“Start-up Protocol”** on (Start-up Protocol / p. 97) and

- continue with “Checking Image Quality” on (Checking Image Quality / p. 71).

Measuring grid lines

1. Load the image in the **syngo Image Viewer** and select the first image where visible grid lines were detected (see (Checking visibility of grid lines / p. 63)).

   To do so, click the **Viewing** tab card, load the image with the **Patient -> Browser** and select **Tools -> Rectangle**.

2. Activate magnification **(Image -> Magnify by 2.0)**.

3. Select **Tools -> Rectangle** and draw a rectangle (approx. **1 sq.cm**) on the "background" as shown in (X/Fig. 43 / p. 65). You have to perform the measurement approx. **2 cm** above the chest wall at the center of the detector. The rectangle should be approx. **5 cm** long

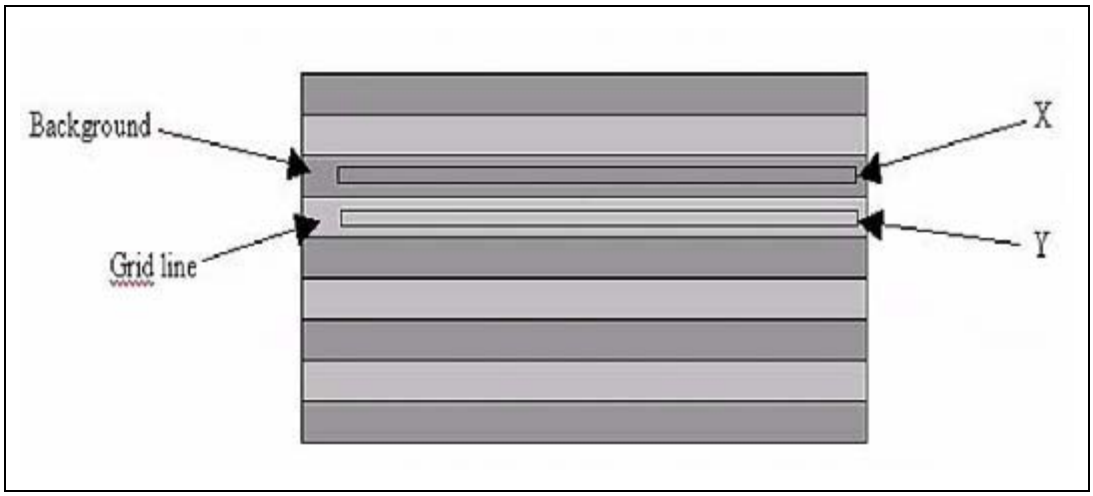


Fig. 43: Measurement of the grid lines

4. Make a new rectangle on a **grid line** according to (Y/Fig. 43 / p. 65). The rectangle should be approximately **5 cm** long.
5. Note the mean value result in column **Y** in (Tab. 15 / p. 66).
6. The mean pixel value difference should be calculated as **(X-Y)/X** where **Y** is the mean value in the grid line and **X** is the mean value in the background as seen in (Tab. 23 / p. 104).

   Note the result in the (Tab. 15 / p. 66).
7. Choose the next image that had visible grid lines in the list and start over with step 3 until all images are evaluated.

Test Protocol

Tab. 15 Measuring Grid Lines

Exposure	Exp Mode	mAs	PMMA/mm	Tube Angle	visible grid lines (yes/no)	X	Y	Mean pixel value difference [%]
1	mAs	32	30	0°				
2	mAs	56	40	0°				
3	mAs	200	60	0°				
4	AEC "H"	-	40	0°				
5	AEC "H"	-	40	+ 60°				
6	AEC "H"	-	40	- 60°				

Test Criteria

If the **mean pixel value difference** is less than 1% for the images with visible grid lines, the test has passed.

If the "mean pixel value difference" does not meet the criteria,

- continue with "Eliminating Grid lines" on (Eliminating grid lines / p. 66).

Otherwise

✍ - Record the measured value in the "**Start-up Protocol**" on (Start-up Protocol / p. 97) and

- continue with "Checking Image Quality" on (Checking Image Quality / p. 71).

Eliminating grid lines

There are various adjustments for eliminating grid line problems:

- Adjusting the grid switch
- Adjusting the "wheel" that is mounted on the grid motor.
- Adjusting the grid location
- Adjusting the grid speed

Adjusting the grid switch

The switch S1, see (Fig. 44 / p. 67), on the detector table disables the high voltage when the grid is in the turning point. The switch must be correctly adjusted. otherwise the high voltage will be active when the grid is standing still.

To minimize this risk of the high voltage being active when the grid is standing still, the high voltage should be disabled for as long as possible.

1. Move the grid to the left end position.
2. Loosen the three screws. Now it's possible to adjust the grid switch (S1) alongside the grid (see (Fig. 44 / p. 67)).

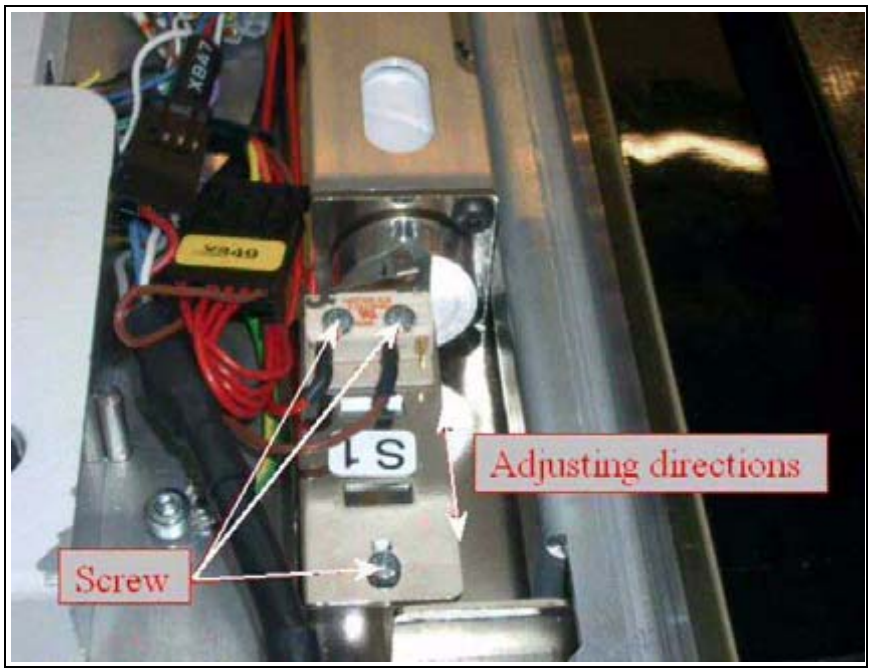


Fig. 44: Adjusting grid switch S1

3. Adjust the grid switch so it will activate and deactivate on either edges of the slits (see (Fig. 45 / p. 68) and (Fig. 46 / p. 68)). You'll hear a "click" when the switch activates or deactivates.

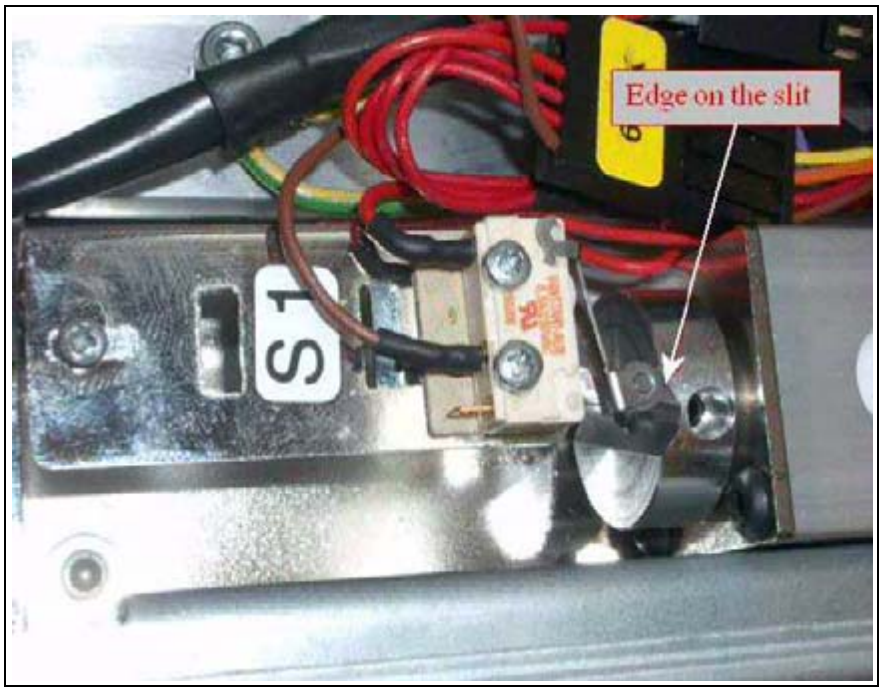


Fig. 45: Adjust grid switch on edge 1

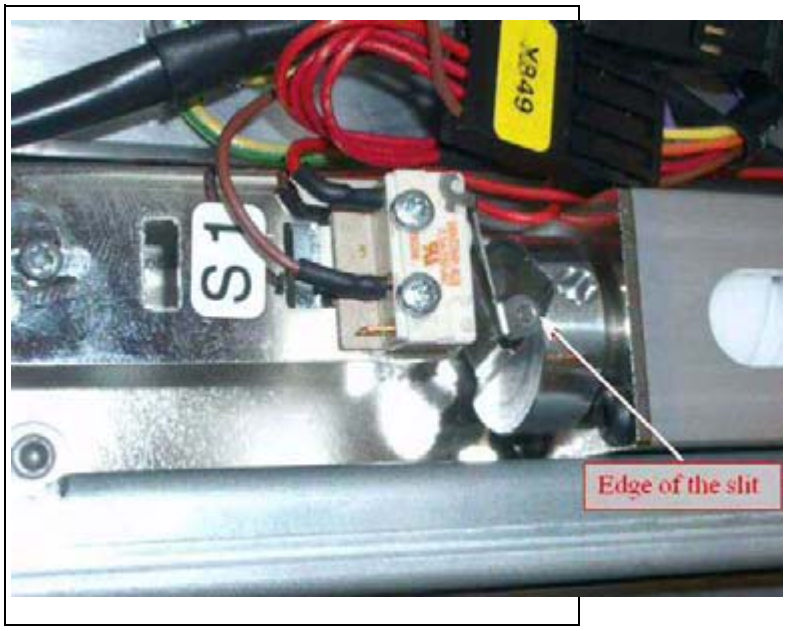


Fig. 46: Adjust grid switch on edge 2

4. Tighten the three screws.
5. Move the grid to the other end position and check that the grid switch activates/deactivates on either edge of the slit (see (Fig. 46 / p. 68) and (Fig. 45 / p. 68)).

Adjusting the "wheel" that is mounted on the grid motor.

A wheel is mounted on the left side of the grid motor (M1); on the wheel there are slits which activate the grid switch (S1).

1. Move the grid to the left end position.
2. Check if the slits are horizontal to the detector table (see (Fig. 47 / p. 69))

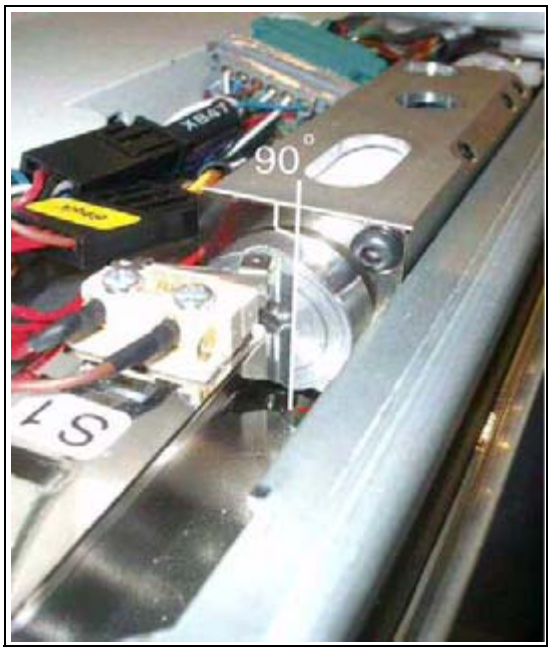


Fig. 47: Adjusting the grid motor wheel

3. Move the grid to the right end position.
4. Check if the slits are horizontal to the detector table (see (Fig. 47 / p. 69)).
5. If the slits are not horizontal, loosen the screw on the wheel and adjust it so that the slits are horizontal in both end positions.

Adjusting the grid location

1. Open the carbon detector cover.
2. Make sure the grid is mounted parallel to the detector and is lined up with the front of the table.

   The front switch has to be engaged and the springs for the grid holders (left and right) have to be engaged; see "Mounting the grid" on (Mounting the grid / p. 28) for more detailed information.
3. Make sure that the springs move up and down easily.
4. Move the grid to the left and right positions. Be sure that space between the grid bracket and grid angle is the same on both sides. Otherwise, loosen the two screws from the grid motor support and adjust the space.

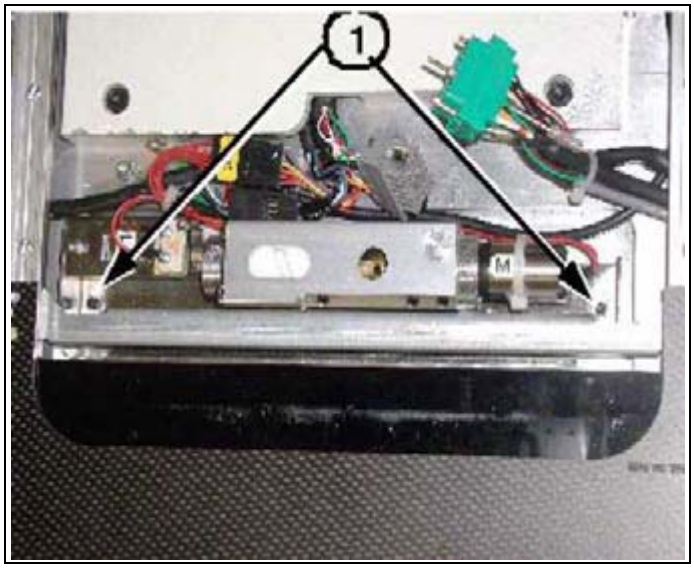


Fig. 48: Adjusting screws

Adjusting the grid speed

1. Start the service software.

   Main menu -> Configuration -> Grid speed

2. Set the parameter as shown in (Fig. 49 / p. 70).

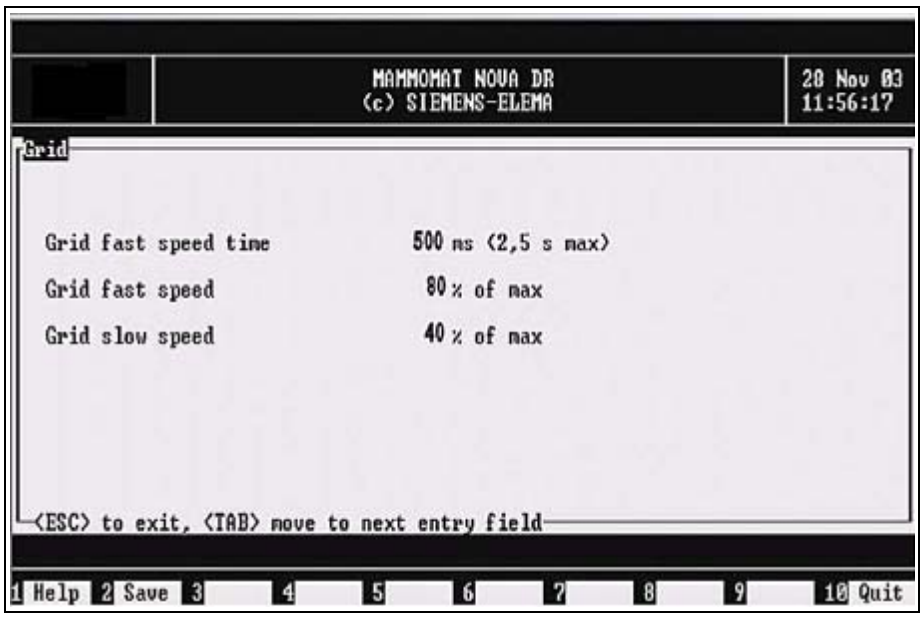

MAMMOMAT NOVA DR
(c) SIEMENS-ELEMA
28 Nov 03
11:56:17
Grid
Grid fast speed time 500 ns (2,5 s max)
Grid fast speed 80 % of max
Grid slow speed 40 % of max
<ESC> to exit, <TAB> move to next entry field
1 Help 2 Save 3 4 5 6 7 8 9 10 Quit

Fig. 49: Adjusting the grid motor speed

3. Check the grid speed with the oscilloscope. The grid speed can be measured with the oscilloscope. See also Mammomat Novation, System Start-up...,SPB7-250.815…chapter "X-Ray tube checks", for systems with WH AWS .

Measurement:

- Switch the system **OFF**

- Connect the oscilloscope as follows:

  Channel 1 to measuring point HV_ACT on the D750, 1 V/T.

  Channel 2 to measuring point Grid_M on the D802, 10 V/T.

  Select time base 0.4 s/T.
- Switch the System **ON**
- Select 28 kV, Mo/Mo, 500 mAS; release an exposure
- Evaluate the oscilloscope diagram.

  The period of the high voltage in a steady state condition (after the 3rd period) has to be between 500 ms and 750 ms. See diagram:

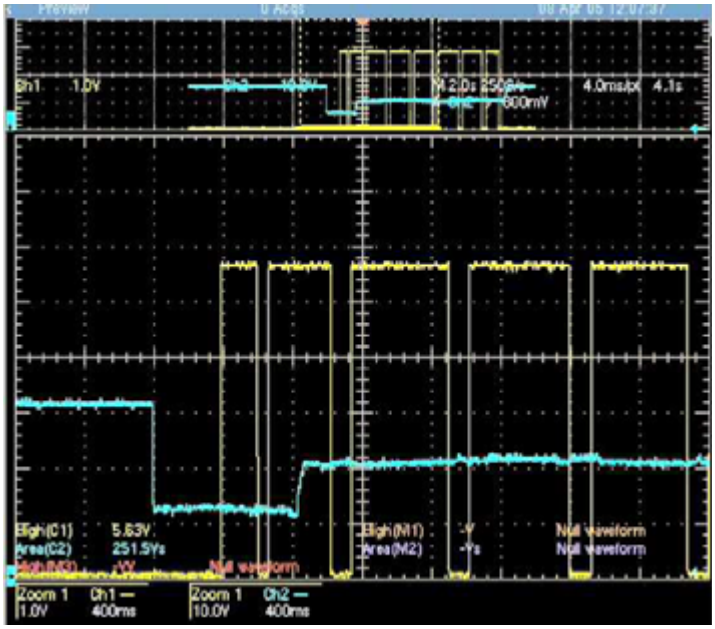


Fig. 50: Grid speed

If the grid lines are still visible after this process , increase. i.e. (change) the grid slow speed from 40% to 50% and run this test again.

Checking Image Quality

While calibration is typically performed by the customer as part of normal system operation, calibration information is provided in the event that you are required to perform a system calibration.

To calibrate the system, proceed as follows:

- First, perform a **gain calibration** of the detector and check the images for bad pixels.
- If you observe any bad pixels in the image, create the **bad pixel mapping** and perform a **gain calibration** of the detector afterwards.

If you have to troubleshoot image quality problems, please see the chapter "Troubleshooting image quality" on (Troubleshooting image quality / p. 108).

Gain calibration

The detector captures charge in its TFT, which is then carried as an electronic signal through charge amplifiers and analog-to-digital conversion to generate a digital signal. While the charge amplifiers are matched, small differences in their performance can result in differences in the X-ray densities detected for the same amount of X-ray.

Performing calibration allows the system to detect these small differences, along with other variables that can affect the digital signal output. The system can then apply adjustments to the output data to compensate for these differences.

When is it necessary to perform the gain calibration of the detector

The gain calibration of the detector must be performed

- every two weeks (a pop-up draws the user's attention to this). Once a week is recommended.

NOTE	**Perform the gain calibration only if the detector has been powered up for at least one hour to ensure it has sufficiently warmed up.**

- when the room temperature has varied by more than **±3°C** (±5.4°F) from the last calibration.

Proceed as follows:

1. Select the **Examination** tab card.

NOTE	**Make sure that no patient is registered before you start the gain calibration.**

2. Select **Patient -> Calibration** from the syngo menu bar.

Fig. 51: Select_calibration

3. Click the **Gain** button to start the calibration.
4. Confirm the message that pops up.

5. As a result, the right screen will change as shown in the following figure.

Fig. 52: Accepting_rejecting the screen

6. Set the following exposure parameter on the control console of the MAMMOMAT Novation DR.

   W/Rh, 28KV, 250mAs

NOTE	**The gain calibration should be performed with the most frequently used anode/filter combination. If the customer uses the system most often with W/Rh, you have to perform the calibration with W/Rh.**

7. Insert the collimator mounted plexi phantom.
8. Mount the compression plate simulator.
9. Double-click the **first** Image of **Procedure: Calibration**
10. Start an exposure.

    Wait until the image is loaded into the viewer. The following lines are displayed in the message bar.

    Image acquisition is in progress .....

    Saving processed Image .....

    Loading Image .....

11. Check the image quality of the image. No objects or artifacts should be visible in the image.

    If you **Accept** the image, the image will be used for gain calibration.

    If you Reject the image, a new image can be acquired for the gain calibration.

    Correct the problem, select the same image from the **Procedure: Calibration Procedure** and continue with step 10.

NOTE

It is recommended to reject an image if it shows any cut-off edges due to collimation or misalignment, or if there are any artifacts from debris or obstructions.

Example images of a calibration.

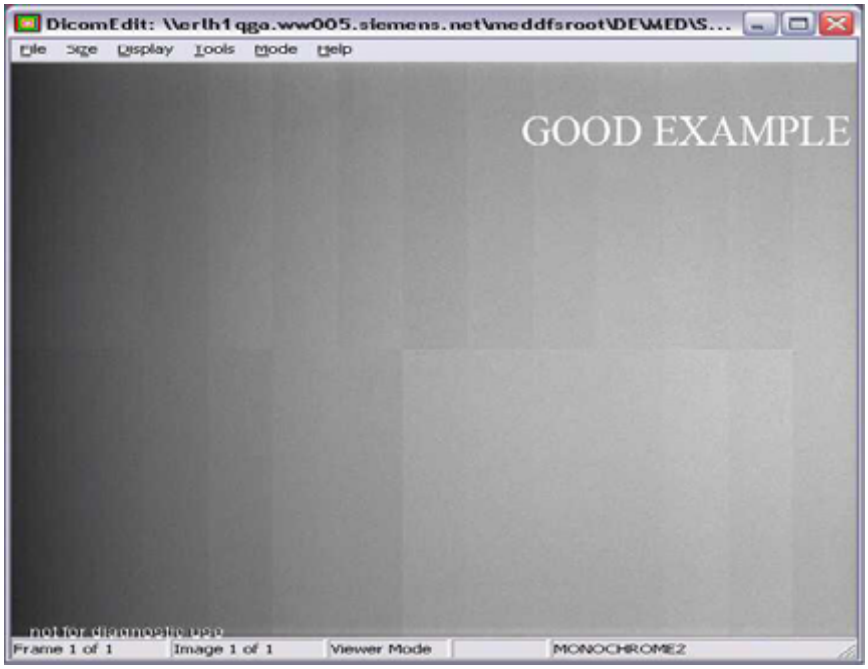


Fig. 53: Gain calibration_good example

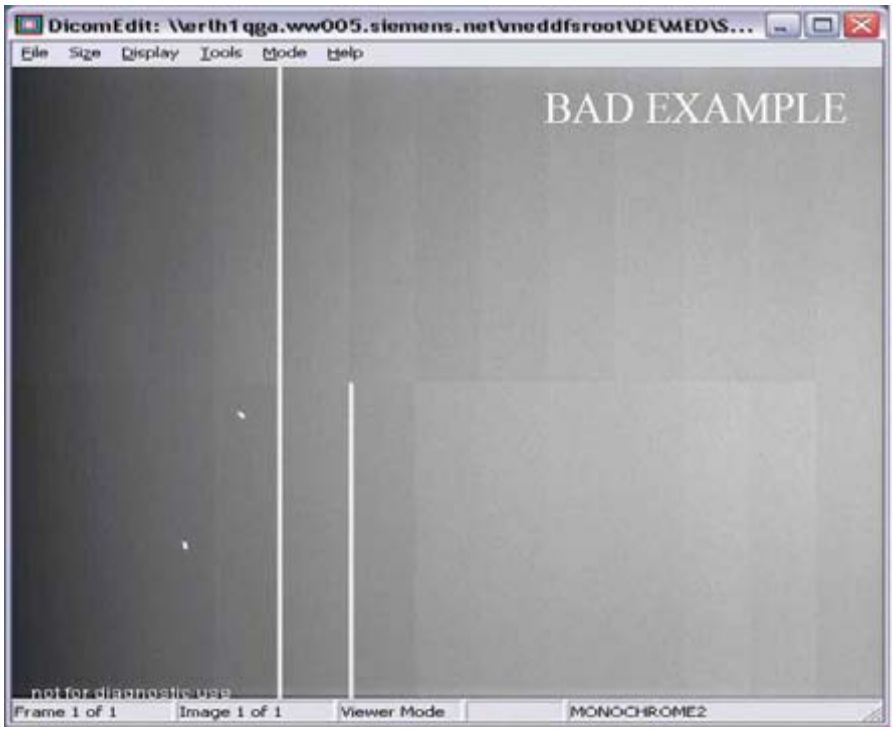


Fig. 54: Gain calibration_bad example

12. Wait approx. **10 seconds** for the image to be calculated; **observe the status bar**.

    Once the **Accepted images** counter increases, the image has been successfully accepted.

13. Double-click the next image in the **Procedure: Calibration** and proceed with step 10 until you have a total of **8** accepted images.

14. Select **Examination -> End Examination** from the syngo menu bar to exit the calibration.

Creation of a new pixel map (if necessary)

During the calibration function, you have the option of creating a new pixel map of the detector. The pixel map indicates which pixels in the detector‘s array might not be reading X-ray densities correctly and therefore should be ignored when the image is acquired. This is similar to a bad spot map for a computer‘s hard disk.

A new pixel map should be created when an excessive amount of pixel dropout is occurring repeatedly on images displayed in the image Preview window.

To create a new pixel map:

1. Start the service software from the syngo menu bar:

   Options -> Service -> Local Service

NOTE	**The Service Level 5 or higher is necessary to do the bad pixel mapping.**

2. Select **Acquisition System.**

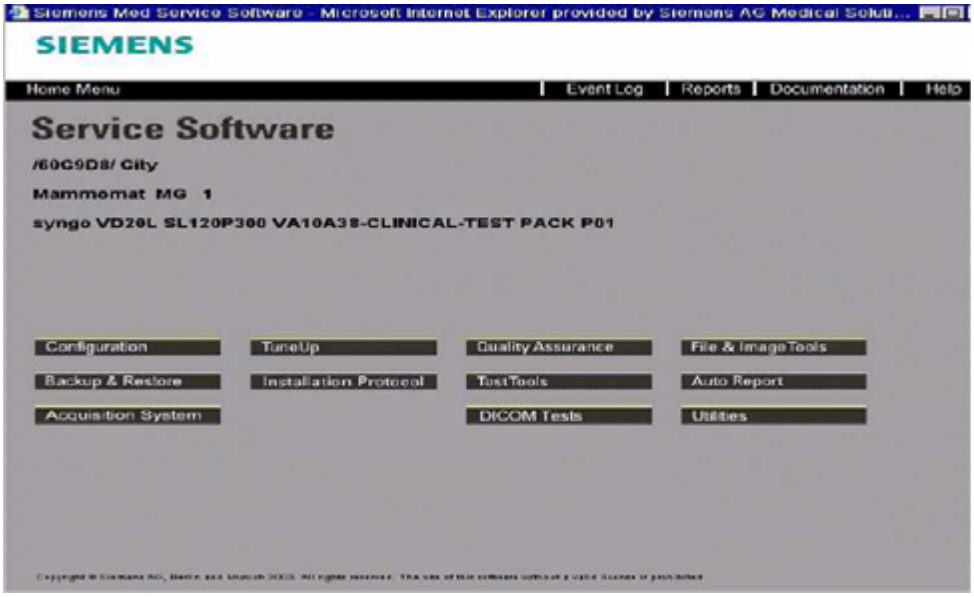


Fig. 55: Service Home Page

3. As a result, the following screen is displayed.

Fig. 56: Acquisition System Menu

4. Select the **Examination** tab card.

NOTE	**Make sure that no patient is registered before you start the bad pixel mapping.**

5. Select **Patient -> Calibration** from the syngo menu bar.

Fig. 57: Calibration

6. Click on the **Bad pixel** button to start the bad pixel mapping.
7. Confirm the message that pops up.

8. As a result, the right screen will change as shown in the following figure.

Fig. 58: Accept_reject screen

9. Set the following exposure parameter on the control console of the MAMMOMAT Novation^{DR}

   Mo/Mo, 28KV, 250mAs

10. Insert the collimator mounted plexi phantom.
11. Mount the compression plate simulator.
12. Double-click the **first** Image of **Procedure: Calibration**.
13. Start an exposure.

    Wait until the image is loaded into the viewer. The following lines are displayed in the message bar.

    Image acquisition is in progress .....

    Saving processes Image .....

    Loading image .....

14. Click the **Accept** or **Reject** button.

    If you **accept** the image, the new pixel map is created. When the **Accept images** counter increases to **1**, no further images need to be taken.

    If you **reject** the image, the **Bad Pixel Mapping** menu is displayed. Correct the problem and return to step 13.

NOTE	**It is recommended to reject an image if it shows any cut-off edges due to collimation or misalignment, or if there are any artifacts from debris or obstructions.**

15. Select **Examination -> End examination** from the syngo menu bar to exit the Calibration.

Tests from the Quality Control Manual

✍ Perform the acceptance tests from the **Quality Control Manual** (See QC Manual,SPB7-250.623...,Appendix 2) for installation in **ROW**.

For installations in the **USA**, perform the acceptance tests according to QC Manual, SPB7-250.623.50...

Remarks on the Quality Control tests:

- **Tube voltage measurement & reproducibility**

  The Quality Control manual suggests using a non-invasive kV meter. If you don't have such a measurement device in your district office, use a scope to measure the kV. Connect the oscilloscope as follows:

  Channel 1 to measuring point **HV_ACT** $_{\textbf{(actual value)}}$ (1 V = 5 kV) on the D750.

- **Beam quality (HVL)**

  The HVL values are supplied with the system and don't have to be measured again with the first installation of the system. You need the HVL for the **Mean glandular dose test** and you can find them in the technical documentation binder in the **Röntgenprotokoll** [X-ray protocol].

Other issues

You'll find the Quality Control documentation in the Instructions for Use binder. It is shipped with the system.

The Quality Control Manual that corresponds to the location of the installation has to be used.

- For the **USA**, the Quality Control Manual (SPB7-250.623.50.xx.24) has to be used.
- For the **ROW** (Rest Of World), the Quality Control Manual (SPB7-250.623.02.xx.02) has to be used.

✍ Make a note in the "Start-up Protocol" on (Start-up Protocol / p. 97) that the tests of the Quality Control Manual have been performed.

Process parameters

NOTE

For Installations in USA, continue with the following "Display contrast and density of images" section.

For installations in ROW (Rest Of World), skip the section "Display contrast and density of images" and continue with the section "Image Processing Parameter" on page (Image processing parameters (only for ROW) / p. 83).

Display contrast and density of images

Display contrast and density of images

It is recommended to adjust the **Display contrast** and **Display density** according to the reporting physician's image expression. The customer has to gain some experience with these settings. If there is any objection with regard to the image quality, it is required to re-adjust the W/Rh Image Display.

The **W/Rh sample images** should be presented to the customer on the monitor of the Mammo Report Plus reporting station. The customer has to choose the type of image rendering with the best quality. The data for display density and display contrast indicated in the center of the sample/demo image (in the center of bottom line) should be entered in the service software.

To view the images on the monitor of the reporting station, select the most suitable image and ensure incorporation of such images into the programmed procedures, the presence of an application specialist is considered necessary.

Loading the sample images

If the sample images are not loaded by the system, proceed as follows.

Prerequisites

- Click the **Resources Monitor** icon (disk space indicator) in the bottom right corner of the syngo screen to check this. The free storage space is shown under the **Local (Blob)** (Blob - Binary Large Object) **Free** entry.

1. Load the images by opening the syngo **Patient Browser.**
2. Select the **cdr** icon
3. Select the desired data objects.
4. Click the **Import** icon, or **Transfer -> Import** menu item.

Presenting the sample images to the reporting physician(s)

1. The sample images need to be transferred to the reporting station, e.g. Mammo Report Plus. (The images cannot be loaded directly into the Mammo Report Plus from its own CD R/W drive. For systems with **MammoReport Plus Syngo**, the images can be directly imported).
2. It is recommended to show the images to the reporting physician(s). The application specialist assisting the customer's staff should take down the comments of the physicians on the individual images indicated on the viewing station.
3. After the customer has selected several images which he/she finds the most suitable for representing the correct image quality, it is recommended to take down the parameters for **DD** (Display Density) and **DC** (Display Contrast), which are indicated in the bottom line (center) of the images

	Default	**Result**
DD (Display Density)	- 0.15	
DC (Display Contrast)	0.70	

Setting the display density and display contrast

- After the customer has selected several images which he/she finds the most suitable for representing the correct image quality, it is recommended to enter the parameters for **DD** (Display Density) and **DC** (Display Contrast) in the ini-file. Proceed as follows for this:

The procedure described there should be performed completely.

1. Call up the local service software and select **Utilities -> Escape to OS**.
2. In the **Parameters** field, enter the command:

   start runas /user:administrator cmd

   The Windows operating system will open a command window. A message may appear, prompting you to enter the appropriate password to log in as administrator. Enter the correct password.
3. A command window will open granting you administrator rights (provided that you are logged in as administrator).
4. Enter:

   notepad C:\AWS\config\LoradIP\AwsIpmParamDefault_Lorad.ini

   and press Return or Enter. A TXT file is called up. In approximately in the **10th** and **11th** line, you can find the values for **DisplayDensity** and the **DisplayContrast**.
5. Change the settings for DisplayDensity and DisplayContrast.
6. Save the changes and close the file.
7. Close the command window and the service software window.
8. Select **Options -> End session** to restart the system and log in with the appropriate user name and the password.
9. After entering the new parameters, a few patient images should be taken to find out whether the changes meet the customer's requirements.
10. Take down the current settings for the image display density /contrast values in the "Start-up protocol" on (Start-up Protocol / p. 97).
11. Continue with "Final procedures" on page (Final procedures / p. 89).

Image processing parameters (only for ROW)

The default values of image processing parameters will be set automatically by the SW installation. According to the reporting physician´s image expression, the parameters **Factor Make Window Width Wider** and **Window Center Shift** can be adjusted to obtain the best results. For more descriptions, see the table Description of Image Processing Parameters.

For these settings, select **Local service >> Acquisition system >> General settings >> Image processing**; see (Fig. 59 / p. 83).The default processing parameter groups cannot be overwritten. For a customer's personal settings, a new group, e.g. Standard, has to be created.

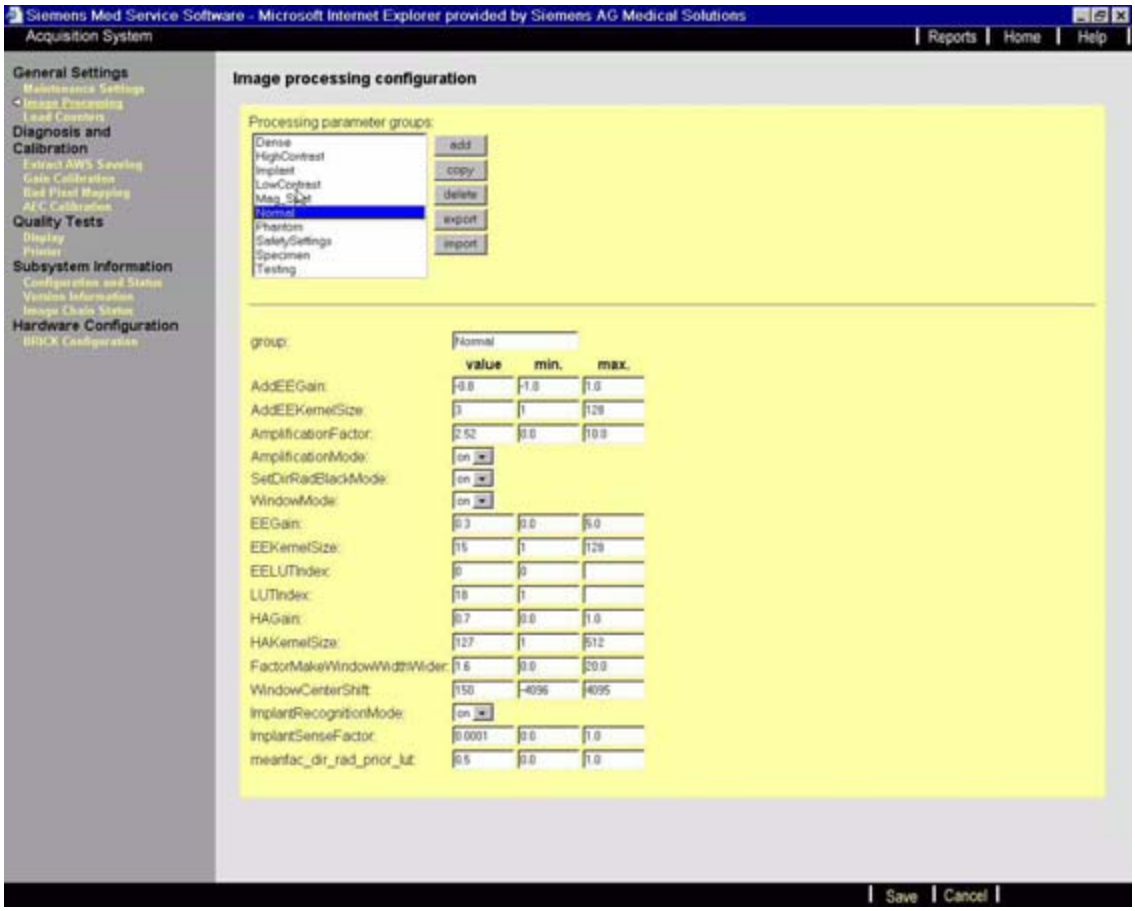


Fig. 59: Image processing parameters

Description of Image Processing Parameters

Parameter	Default Value	Description	Changeable
Additional Edge Enhancement Gain	-0.8	Gain value for additional noise filtering	Do not change
Additional Edge Enhancement Kernel	3	Kernel value for additional noise filtering	Do not change

Parameter	Default Value	Description	Changeable
Amplification Factor	2.52	Fix value for amplification, only used when mode = OFF	Do not change
Amplification Mode	ON	See above	Do not change
Set Direct Radiation Black	ON	Takes care that direct radiated area is set to black	Do not change
Window Mode	ON	ON: Complete area of breast is taken into account for the calculation of the window/center values OFF: only compressed area is taken into account for the calculation of the window/center values	Do not change
Edge Enhancement Gain	0.3	Gain value for enhancement of the local contrast	Do not change
Edge Enhancement Kernel	15		Do not change
Edge Enhancement LUT index	0	Currently not used; future plan to have different edge enhancement based on mean gray value in image	Do not change
LUT index	18	Separate LUTs to calculate the displayed values are delivered	Do not change
Harmonization Amplification Gain	0.7	Gain value for enhancement of the global contrast	Do not change
Harmonization Kernel Size	127	Gain value for enhancement of the global contrast	Do not change
Factor make window width wider	1.6	Defines range of gray values to be displayed	Decrease if image should have more contrast; increase if image should have less contrast; 3 predefined settings exist: Normal, Low, High

Parameter	Default Value	Description	Changeable
Window Center Shift	150	Defines center of gray values to be displayed	Decrease if image should be brighter; Increase if image should be darker; 3 predefined settings exist: Normal, Low, High
Implant Recognition Mode	ON	Defines whether implants should automatically be recognized	Do not change
Implant Recognition Sensitivity Factor	0.0001	Defines sensitivity for recognition of implants	Do not change
MeanFactor LUT	0.5	Defines an initial threshold for the recognition of the breast tissue	Do not change

Three presets, “Normal”, “High” and “Low”, are used to change the impression of the images to have medium contrast, high contrast or low contrast, depending on the customer’s preferences. To figure out what the customer would like, a standard operating program can be generated, including the different settings. Play around with the first images generated by using the ‘Reprocessing’ function during acquisition.

To view the images on the monitor of the reporting station, select the most suitable image and ensure incorporation of such images into the programmed procedures, the presence of an application specialist is considered necessary.

The presets “Mag/ Spot”, “Implants”, “Specimen” and “Phantom” should be used if examinations of these types are performed. In case the image processing fails completely, using ‘Reprocessing’ with the ‘safety’ setting should correct this problem.

Parameter	Normal	High	Low	Mag/Spot	Implant	Specimen	Phantom	Safety
Additional Edge Enhancement Gain	-0.8	-0.8	-0.8	-0.8	-0.8	-0.1	0	-0.8
Additional Edge Enhancement Kernel	3	3	3	3	3	3	3	3
Amplification Factor	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52
Amplification Mode	ON	ON	ON	ON	ON	ON	ON	OFF

Parameter	Normal	High	Low	Mag/Spot	Implant	Specimen	Phantom	Safety
Set Direct Radiation Black	ON	ON	ON	OFF	ON	OFF	OFF	OFF
Window Mode	ON	ON	ON	OFF	ON	OFF	OFF	ON
Edge Enhancement Gain	0.3	0.3	0.3	0.3	0.3	0.1	0.0	0.3
Edge Enhancement Kernel	15	15	15	15	15	15	15	15
Edge Enhancement LUT index	0	0	0	0	0	0	0	0
LUT index	18	18	18	18	20	6	6	6
Harmonization Amplification Gain	0.7	0.7	0.7	0.7	0.6	0.2	0	0.6
Harmonization Kernel Size	127	127	127	127	127	127	127	127
Factor make window width wider	1.6	1.4	1.8	2.0	1.5	2.0	2.0	1.6
Window Center Shift	150	120	180	-50	140	0	0	150
Implant Recognition Mode	ON	ON	ON	ON	ON	OFF	ON	ON
Implant Recognition Sensitivity Factor	0.0001	0.0001	0.0001	0.0002	0.00025	0.0001	0.0001	0.0003
meanfac_dir_rad_prior_lut	0.5	0.5	0.5	0.35	0.5	0.35	0.35	0.35

These settings are the default ones, available upon installation

L**oading the sample images**

If the sample images are not loaded by the system, proceed as follows.

Prerequisites

- Click the **Resources Monitor** icon (disk space indicator) in the bottom right corner of the syngo screen to check this. The free storage space is shown under the **Local (Blob)** (Blob - Binary Large Object) **Free** entry.

1. Load the images by opening the syngo **Patient Browser**
2. Select the **cdr** icon
3. Select the desired data objects
4. Click the **Import** icon, or **Transfer-> Import** menu item.

Procedure for creating customer-specific IPPG settings.

Clinical patient instances are included on an additional CD. This CD contains 3 patients with one CC and one MLO exposure each.

- These images need to be transferred to the reporting station, e.g. Mammo Report Plus.
- It is recommended to show the images to the reporting physician(s). The application specialist assisting the customer's staff should take down the comments of the physicians on the individual images indicated on the viewing station.
- For each of the 3 patients, the IPPG settings Normal, Low Contrast and High Contrast are available. If the customer wants to adjust the basic settings for brightness and contrast, the images must be windowed according to the customer's preferences based on an IPPG setting.
- New values for window width and window center can be determined using the **image processing configurator**. The values set by the customer as the optimal ones are entered in the configurator, whereupon the average values are determined.
- The new values (window width and window center) can then be entered in a newly created IPPG (e.g. called "Standard") and stored.

The **image processing configurator tool** gives assistance in determining the customer-specific values. It can be downloaded from the Siemens Med Intranet at:

CS/For Service/SP/Mammography/Mammomat Novation DR WH AWS/Software

How to use the configuration tool

1. Import the example images to the AWS and send it to the MammoReport
2. If the customer wants to adjust the default contrast or brightness of the images, choose the "Processing Parameter Group" (PPG) that fits the best and optimize the window settings to the personal preferences of the customer, e.g. "Normal"
3. Start the configuration tool
4. Choose the "Processing Parameter Group" (PPG) on which you based the optimization, e.g. "Normal"
5. Enter the new window level and width value for every patient and choose **"Calculate"** to get the new parameters

6. Select the local service menu of the **AWS -> Acquisition System -> Image Processing**
7. Make a copy of the PPG on which you based the optimization of the contrast and the brightness, e.g. "Normal" and change the name to e.g. "Standard".
8. Change the parameter "Window Center Shift" and "Factor make window width wider" to the new values displayed in the configuration tool and save the PPG

The new calculated values for **Factor make window width wider** and **Window Center Shift** have to be entered in the corresponding fields.

Tab. 16 Settings for normal parameters

	Default	Result
Factor make window width wider	1.6	
Window Center Shift	150	

Disabling the film exposure

The film exposure switch has to be **disabled**.

1. Connect the service PC to the MAMMOMAT stand and start the service software.
2. Go to:

   Configuration -> Miscellaneous -> Allow film exposure

   and make sure that the **Switch** is set to **OFF.**

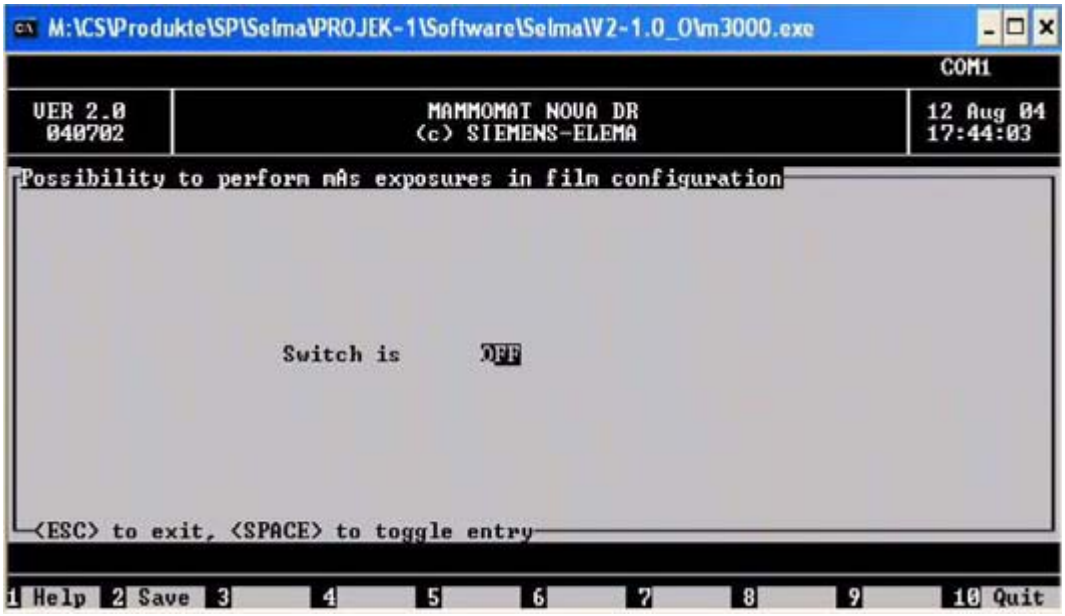


Fig. 60: Set Allow film exposure to OFF

Settings date and time

MAMMOMAT Stand

Prerequisite

- The correct date and time must be set in the service PC. If not, set the date at C:\> by typing **date** <ENTER> and the time at C:\ by typing **time** <ENTER>

Test performance

1. Start the Service Software for the MAMMOMAT Stand on the Service PC.
2. In the **Main menu**, select **Configuration -> Clock**.

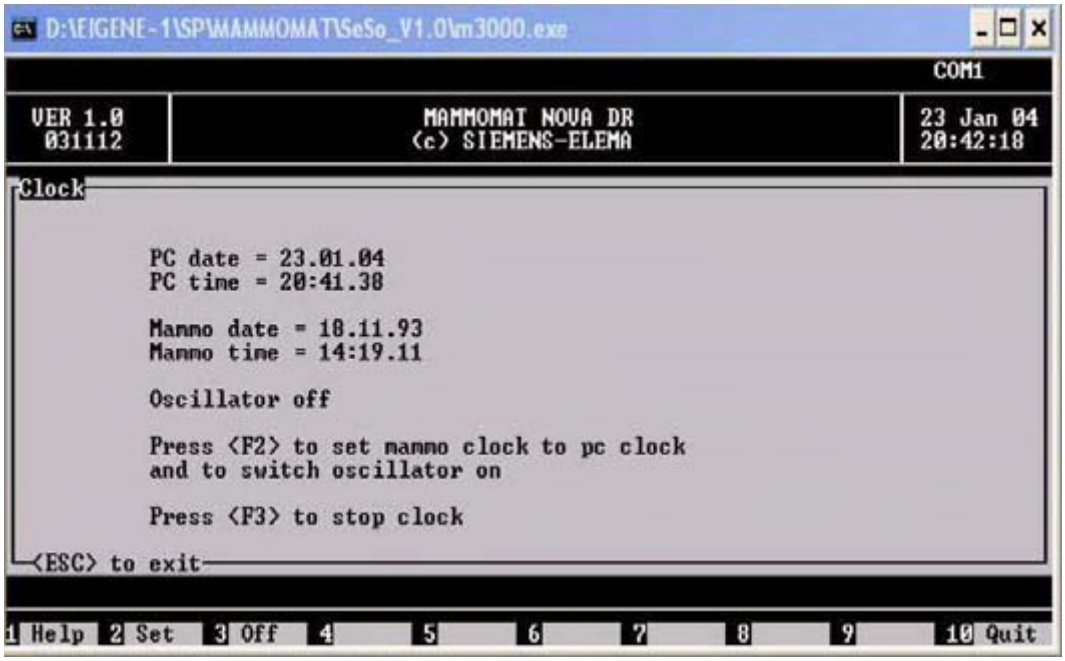


Fig. 61: MAMMOMAT Stand clock adjustment

3. Press **<F2>**.

   With **<F2>** the date and time set in the service PC are taken over by the MAMMOMAT stand.

BRICK

1. Call up the WH AWS service software and select **Utilities -> Escape to OS**. Enter then the following command in the **Command** field.

   start telnet brick

2. A Username and Password have to be entered

   Username: **root**

   Password: ******

3. To check the current date and time setting on the BRICK, use the following command:
   brick# **date**

   To set the date and time on the BRICK, use the following command:
   brick# **date mmddHHMMyy**
   mm - month
   dd - day
   HH - hours
   MM - minutes
   yy - year

   The following example sets the system to 3:10 p.m. on November 21, 2004:
   brick# **date 1121031004**

Service PC and measuring instruments

Saving the configuration file

NOTE	**Make sure that the backup floppy is inserted.**

Main menu:

1. Select: **Configuration -> Save config file**.
2. Press **F2** to save the data.

Reset the exposure counter

Main menu:

1. Select: **Service -> Reset exposure counter**.
2. Delete the error memory with **Y**.

Deleting the error buffer

Main menu:

1. Select: **Service -> Delete error buffer**.
2. Delete the error memory with **Y**.

Saving the MAMMOMAT Parameters

Main menu

1. Select **Backup -> Copy Installation Area to Floppy -> Stand**.
2. Select **Backup -> Copy Installation Area to Floppy -> Panel**.
3. Exit the program with **F10** when the backup is completed.

NOTE	**Keep the backup floppy with other documentation for the MAMMOMAT Novation^{DR} in question.**

Remove the measuring instruments

1. Turn **OFF** the MAMMOMAT.
2. Remove the service PC.
3. Remove connected measuring instruments.

Checking the protective grounding resistance

Using the protective ground wire tester, measure the resistance between the protective ground terminal in the stand (Mains input terminal) and all metallic parts of the equipment which the patient/operator may come in contact with, incl. all object tables.

The protective ground resistance must not exceed **0.1 Ohm**

Warning label on control panel

The control panel warning label comes in eleven languages; English, German, French, Spanish, Italian, Dutch, Danish, Norwegian, Finnish, Greek, and Swedish. The warning labels are found in a plastic bag under thumb index 3 in the Technical Manual.

NOTE	**A warning label in English is provided on delivery.**

Choose the appropriate language and affix the label over the existing label on the control panel, see (Fig. 62 / p. 95). Be sure to position the label properly before affixing it. The label sticks immediately.

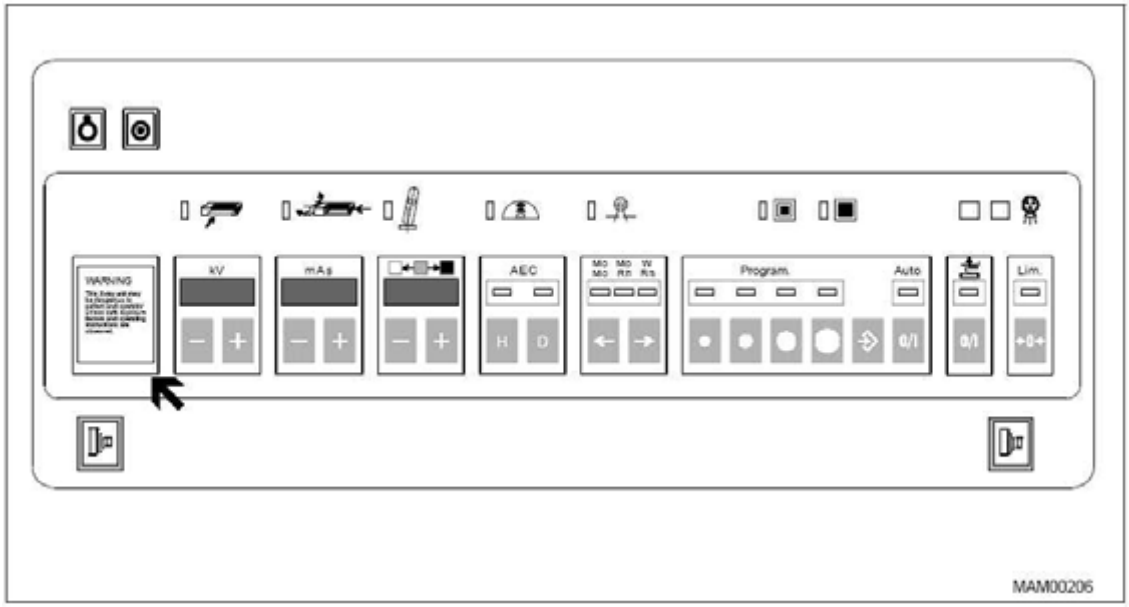


Fig. 62: Warning label on control panel

Protocols

- The manufacturer of this product requires information and the legislator demands proofs that a product delivered free of defects from the factory continues to possess the required and certified quality properties on installation and start-up.It is therefore absolutely necessary that the installation Protocol with the installation and start-up data is sent without delay after completion of the work to the address stated on the installation protocol.
- The SP Q 'Installation Protocol' has to be filled in and signed. The form can be found in chapter 9 'Certificates' of the technical documentation binder (Appendix of 66 46 900 QZE 01S xx). It has to be sent to the address stated on the protocol.
- You will find the protocol in the system folder Place a copy of the protocols in the technical documentation binder.
- The **Startup Protocol** and the **Installation Protocol** remain with the system.

Site Data

SAP No.: _____ System Ser. No.: _____

Customer: _____

Country/city: _____

Installation team: _____

Project manager: _____

Installation start: _____ Installation end _____

Auxiliary materials used

Tab. 17 Auxiliary materials

Item	Model	Calibration date	Serial number
Oscilloscope >50MHz with memory			
Digital multimeter including an mAs meter			
Power line impedance meter			
Power ground-wire tester			
Luminance meter (for monitor calibration)			
Luminance meter (measures the light intensity from the X-ray field)			
Dose meter			
Ion chamber			
Densitometer			
A non-invasive digital kV meter			

Installation and start-up steps performed

	Work performed	
	Yes	**No**
Installation:		
The MAMMOMAT Novation^{DR} was installed completely	❒	❒
All covers are mounted.....	❒	❒
The temperature logger was sent to DirectRay Cooperation (DRC)...	❒	❒

	Work performed	
	Yes	**No**
Start-up:		
Check power supply voltages	❒	❒
Mechanical checks performed	❒	❒
X-Ray tube checks performed	❒	❒
Collimator checks performed	❒	❒
Dose settings checked	❒	❒
Acquisition workstation configurations performed	❒	❒
Configured DICOM services	❒	❒
Image quality tests performed	❒	❒
Acceptance tests performed	❒	❒
Ground wire tested	❒	❒
Line resistance tested	❒	❒
Backup for acquisition workstation and MAMMOMAT created.....	❒	❒
SP Q "Quality Certificate" filled in and sent, when problems occurred with either the Installation or Start up.	❒	❒

Startup Settings

Tube high voltage, current and mAs values

Results from the chapter "Tube high voltage, current and mAs values" on (Tube high voltage, current and mAs values / p. 44).

kV mAs Anode/ filter	Measured values	Result kV must be ±5% mAs must be ±10%
☐ 30 kV 20 mAs Mo/Mo	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs
☐ 30 kV 20 mAs W/Rh	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs
☐ 35 kV 100 mAs Mo/Mo	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs
☐ 35 kV 100 mAs W/Rh	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs
☐ 25 kV 100 mAs, Mo/Mo	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs
☐ 25 kV 100 mAs W/Rh	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs
■ 30 kV 10 mAs Mo/Mo	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs
■ 30 kV 10 mAs W/Rh	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs
☐ 25 kV - Mo/Mo	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs Display _____ mAs
☐ 25 kV - W/Rh	_____V x 5 kV = _____V x (_____s + _____s + _____s) x 40 mA =	_____ kV _____ mAs Display _____ mAs

Fig. 63: Start-up Settings

Collimator beam calibration

Results from the chapter "Collimator beam calibration" on Page (Collimator beam calibration / p. 50).

Tab. 18 Collimator beam calibration

Focus and Anode	XL	XR	YC	YS
Small focus molly				
Large focus molly				
Small focus tungsten				
Large focus tungsten				

Collimator field light calibration

Results from the chapter "Collimator field light calibration" on (Collimator field light calibration / p. 52).

Tab. 19 Collimator field light calibration

	XL	XR	YC	YS
Light field				

Collimator wing difference

Results from the chapter "Collimator Wing Difference Calibration" on (Collimator Wing Difference Calibration / p. 53).

Tab. 20 Wing difference

	XL	XR	YC	YS
Wing difference				

AEC dose settings

Results from the chapter "Checking the AEC dose settings" on (Checking the AEC dose settings / p. 58).

Tab. 21 AEC Dose settings

AEC	kV	Anode / Filter	Dose value	Pixel value
H	28 kV	Mo/Mo		
D				
H		Mo/Rh	-	
D			-	
H		W/Rh	-	
D			-	

OPDOSE settings

Results from the chapter "Checking OPDOSE" on (Checking OPDOSE / p. 57).

Tab. 22 OPDOSE Settings

Program button	Thickness	kV	Anode/filter combination	AEC
1				
2				
3				
4				

Check of grid lines

Results from the chapter "Checking Grid Lines" on (Checking Grid Lines / p. 63).

Tab. 23 Measuring Grid Lines

Exposure	Exp Mode	mAs	PMMA/ mm	Tube Angle	visible grid lines (yes/no)	X	Y	Mean pixel value difference [%]
1	mAs	32	30	0^{o}				
2	mAs	56	40	0^{o}				
3	mAs	200	60	0^{o}				
4	AEC "H"	-	40	0^{o}				
5	AEC "H"	-	40	$+ 60^{o}$				
6	AEC "H"	-	40	$- 60^{o}$				

Display contrast and density of images

Results from the chapter "Image Processing Parameters" on (Image processing parameters (only for ROW) / p. 83).

Tab. 24 Contrast and Density Settings

	Default	Result
Factor make window width wider	1.6	
Window Center Shift	150	

Activity report

Day	Start	End	E	M	V	R	KA	Work performed	Employees/number
Total (Mh)									

Explanation of the activity report

Day / Start End	Date / start of work / end of work (time)
E	Bringing in the entire system in hours per/day
M	Installation of the entire system in hours per/day
V	Cabling of the system in hours per/day
R	Travel time in hours per/day
KA	No order-related working time in hours per/day

Work performed	Work performed in the time
Employees/number	Number of employees who were employed in the period
Total (Mh)	Man hours, number of accumulated hours multiplied by number of employees

General Remarks

A copy of this remains at the system and is filed in the Assembly/Installation folder.

_____	_____	_____
Place, date	Installation team employee	Siemens project manager/ person responsible for the project
	_____	_____
	Name in block letters	Name in block letters

Troubleshooting image quality

Various components, when operating incorrectly, can yield a variety of unacceptable imaging artifacts. These artifacts can come from anywhere along the chain of image capture, conversion, and display. The tables in this topic suggest the causes and corrective responses for particular problems.

A key step in analysis is to isolate the artifact to the component that is producing it. First, similar appearing artifacts can come from anywhere in the overall image chain. Second, the tendency to assume that the artifact is coming from the least known component must be avoided. For example, artifacts that appear to be coming from the detector may actually be coming from the output device or processing.

Isolation is the first step and should be done by using internallygenerated image patterns in the image chain to determine where exactly the artifact is being produced (“what is/what is not” the artifact analysis).

The following tables provide direction for cause and corrective action for those artifacts that have been validated as coming from various components

Line Artifacts		
Problem	**Cause**	**Recommended Action**
Line Parallel to the Short Axis	Seam: • Seam correction algorithm not turned on; wrong algorithm selected. • Detector gain not calibrated properly. • Seam (lines 1535 and 1536) needs to be mapped out. Source lines: • detector not calibrated properly. • line needs to be mapped out.	• Perform detector calibration procedure (refer to "Gain calibration" on (Gain calibration / p. 72). • Perform detector calibration procedure (refer to "Gain calibration" on (Gain calibration / p. 72)). • Perform the bad pixel correction. (Refer to "Creation of new pixel map" on (Creation of a new pixel map (if necessary) / p. 76)).
Line Parallel to the Long Axis	Line ends at seam or line partially defective (gate lines).Line ends at seam or line partially defective (gate lines). • Detector not calibrated properly. • line needs to be mapped out.	• Perform detector calibration procedure (refer to "Gain calibration" on (Gain calibration / p. 72)). • Perform the bad pixel correction. (Refer to "Creation of new pixel map" on (Creation of a new pixel map (if necessary) / p. 76)).
Line Runs Through Seam	• Read out problem; HV setting time too short. • Hard copy device or processor artifact.	• Follow applicable problem solving.

Random Artifacts		
Problem	**Cause**	**Recommended Action**
Increase in Defective Pixels and Lines	Defective pixel file requires updating.	• Perform the bad pixel correction. (Refer to "Creation of new pixel map" on (Creation of a new pixel map (if necessary) / p. 76)).

Structured Artifacts		
Problem	**Cause**	**Recommended Action**
Appearance of 24 “256 blocks” of different Densities or Counts	Gain calibration not turned on. Detector not calibrated properly.	Follow calibration procedure.
Image not appearing in One or More “256 blocks”	Detector defective.	Detector might have to be replaced contact the Service Center.
Image not appearing in one or more quarters of Detector	Detector defective.	Detector might have to be replaced contact the Service Center.
Garbled, scrambled, or truncated (from edges of long axis in) images not appearing in one or more quarters of Detector	Poor cable connection. Electronic interference with or along cable.	Check pins and Detector connection to PXCM. Identify and isolate sources of interference; examine the cable pathway.
Fine Linear Pattern, Parallel to Long Axis, in One or More “256 Blocks” (usually more pronounced on an edge)	Electromagnetic noise interfering with Detector Read Out.	Shield Motors, power sources, and so on, located in proximity to the detector.

Other Artifacts		
Problem	**Cause**	**Recommended Action**
White lines towards the center of panel (Bar Code)	Detector defective.	Detector might have to be replaced contact the Service Center.
Dark lines / weak lines	Lines need to be mapped out.	Contact the Service Center.

Other Artifacts		
Problem	**Cause**	**Recommended Action**
Poor image quality	Detector not calibrated to optimal operating temperature.	Allow proper warmup time to normal operational temperature.
Distorted image with 256 blocks	Detector defective.	Detector might have to be replaced contact the Service Center.

Working with the service PC

Description of the syntax used in these instructions

<.....>	The function keys to press is indicated between these characters, for example <ENTER>, <ESC> etc.
CAPITALS	Capital letters indicate data which must be entered unchanged, for example the name of a register, file etc.
Italics	Italics represent data in which a value should be entered, e.g. for user name, the name of the technician should be entered.
[.....]	Square brackets enclose additions to commands which may be optionally entered.
Bold	Data relating to formats, user entries etc., which is important for the following entry, is shown in bold as it appears on the monitor screen.
_____	This character indicates that at this point the space key must be pressed.
xx yy zz	Data can be entered in place of "x, y, z" (e.g. day´s date).
{...}	Curved brackets indicate that one item must be selected from a list of several terms.
	Important remarks are indicated by this box.
* * * * *	When the password is entered, only these characters are shown.
Menu Selection:	When several menus, programs, files etc. are presented for selection, they are shown in a box (program window).
	Selection is made with the <↓> and <↑> keys. The module selected is highlighted in the display.
<ENTER>	Every entry must be confirmed with the <ENTER> key.
<ESC>	ESC allows paging back through the program.
<xx> + <y>	Some functions are selected by pressing two keys simultaneously. Procedure: For example, press and hold the <Shift> key, press the <*> key and then release both keys.
<F1>	Key <F1> calls up a selective help text.
<F10>	Key <F10> exits the program.
PLD	Programmable Logic Device on the AEC board (D701).
Flash	Memory device on the AEC board (D701).
OS	Operating System, e.g. "Microsoft® Windows®"

BIOS	Basic Input and Output System, a program stored in the computer hardware which launches start-up functions when the computer starts.
XXX ⇒ XXX ⇒ XXX ⇒ XXX	This shows where a particular subroutine can be found. For example: **Main menu ⇒ Configuration ⇒ AEC ⇒ Sensitivity correction**

Connecting the service PC

The service PC must be connected with connecting cable part no. 99 00 440 RE999 to the p.c. board in the generator (do not insert the diskette in the drive yet).

Configuring the service PC

All Service Programs use the RS232 port in order to communicate with the MAMMOMAT. This port is usually handled as COM1 by the OS of the service PC. Modern PC's can be equipped with new types of communication hardware, e.g. infrared port and built-in modem, which may act as COM1 or share resources with COM1. This could cause malfunction of the Service Programs for the MAMMOMAT, which requires the OS and computer BIOS to be re-configured.

The following procedures are designed to ensure general compatibility with the OS's Windows® 2000 Pro on modern PC's. If the settings are saved, this procedure has to be done only once.

Configuring the computer BIOS

1. Enter the BIOS setup, usually done by pressing e.g. <F2> during the boot sequence of the BIOS.
2. Find the configuration of the IrDA (Infrared device) port and disable it.
3. Find the configuration of a built-in modem and make sure it is configured as COM3.
4. Find the configuration of COM1 and make sure it uses the interrupt IRQ 4 and the memory address range 03F8 - 03FF.
5. Save the BIOS settings and restart the PC.

Configuration of Windows® 2000 Pro

1. Choose Settings from the Start Menu.
2. Choose Control Panel.
3. Choose System.
4. Choose the tab Hardware.

5. Press the button Device Manager. If the IrDA port was disabled in the computer BIOS, it should not be present in the list of available hardware. If the IrDA is present anyway and its icon is not marked with a red cross:
6. Double-click on the device row.
7. Choose the tab General in the dialog box that appears.
8. In the section Device Usage, change the status to "Disabled in the current hardware profile".
9. Exit the dialog by pressing the OK button.

   Having performed the configurations described above, the Service Program should be able to communicate without difficulties.

Starting up and using the service PC

1. Switch on generator and service PC. After initialization, the service PC shows: C:\>
2. Insert the diskette with the service program.
3.

   Select the appropriate drive {**A:**} or {**B:**} and then press <ENTER>.

   The screen shows: **A:**\> or **B:**\>
4. Start the service program by typing 'SERVICE' (extension -c if you have a color display), then press <ENTER>. The program asks for the user's name: **Your name, please** Type the name of the technician, for example NN, and then press <ENTER>.
5. The program asks for the password: **Password, please** Type the password (********) and then press <ENTER>. The display window shows: **Main menu**
6. Select the program part to be used with keys <↓> and/or <↑>, then press <ENTER>. The selected program part is shown with a background: **Configuration**

   If necessary, additional subroutines can be similarly selected here.
7. Make the necessary entries in the appropriate part of the program. Save the entered data with <F2>. Page back in the program with <ESC>. The appropriate instructions are shown on the monitor.
8. End the procedure with the service PC using <F10>.

Troubleshooting PC connection

If communication with the MAMMOMAT Novation^{DR} still cannot be established, follow the instructions in this section. The following procedure will disable the buffering of the RS232 port. This example is for Windows® 2000 Pro.

1. Choose Settings from the Start Menu.
2. Choose Control Panel.
3. Choose System.

4. Choose the tab Hardware.
5. Press the button Device Manager.
6. Expand the row Ports.
7. Double-click on the COM1 row.
8. Choose the tab Port Settings.
9. Press the button Advanced.
10. Uncheck the check box Use FIFO Buffers
11. Exit the dialog by pressing the OK button.

Chapter	Page	Change
Checking dose settings	55.	Source of “Configuring of Dose Calculation" adapted
Final work steps	92	"Saving the Mammomat Parameters" adapted